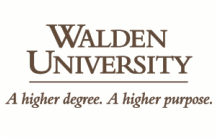

2018

A Causal Layered Analysis of Assistive Technology for the Cognitively Impaired Elderly

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This is to certify that the doctoral dissertation by

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has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
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2018

Abstract

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by

Dariusz J. Ropiak

MS, Walden University, 2010

BA, Queens College CUNY, 2006

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Policy and Administration

Walden University

November 2018

Abstract

Assistive technology may delay cognitively impaired elders' need for long-term institutionalization, and the promote independence. Its use is on the rise, yet the gap between the needs of the cognitive impaired elderly and what developers of the assistive technologies design, manufacture, and implement, remains to be filled. Using Inayatullah's 6-pillar approach, as the guide to the future of assistive technology, the purpose of this qualitative study was to explore how assistive technologies may fulfill the daily functional needs of the cognitively impaired elderly with Alzheimer's or other dementia by 2037. Data were collected from a focus group of 10 seniors at a senior center in a large mid-Atlantic city, as well as survey data from with 5 family members of the cognitively impaired elderly and 16 technology developers from an engineering society. These data were coded according to the thematic content analysis and causal layered analysis. The future triangle analysis served as a second layer of analysis. Findings indicated that the most desirable outcome for 2037 is that of the "happy retiree," characterized by flourishing cultural and financial opportunities, and the least desirable is that of the "struggling pensioner" characterized by monetary gains of the social elite at the expense of the poor and working class. The most expected outcome, though, is the "caring robot" that is characterized by the use of technology and artificial intelligence to promote equitable social and health care benefits to aging citizens. Positive social change may be achieved through recommendations to state, local, and national policy makers that support the improvement in the elders' well-being, the delay of hospitalization, and greater support for the duties of family members, and greater caretaker independence.

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Dedication

This dissertation is dedicated to my father Boleslaw Ropiak, an inventor, and entrepreneur, known to his friends as Bolek, whose dementia progressed as he aged. Dad would have benefited immeasurably from many of the assistive technologies that exist today.

To Remember all Fathers as They Were

I remember the day
When you were not far away;
It never entered my mind
That one day I'd find
All the treasures we shared,
To show that we cared,
Would be buried too deep
As your thoughts turn to sleep.
Your senses are dulled
By the strokes that have culled
Little sections of brain,
As the senses they drain.
Wreaking havoc within,
A fight you can't win;
As your memories fade
Of the life that you made.

We watch you depart

And it's breaking our heart,

When we see the demise

With our very own eyes.

If only we could

I know that we would

Have the father we know

Sophia Mosely

Acknowledgments

My journey would not have been possible without the support and encouragement of my mentor and chair, Dr. Christopher Jones, who challenged and guided me throughout the dissertation process. I would like to thank Dr. Anne Hacker, and Dr. Tanya Settles, for their support. I also like to thank my coworker, and a friend, and short story writer, Thomas Lane, who patiently edited my work, Dr. Zahoor Haque, who kept me on track, and Dr. Sharonica Johnson, for being my cheerleader. I would like to thank my supervisor Koo Suat who always allowed me to take time off when I needed to be away from work. I also like to thank my family, my wife, Patricia Ropiak and my now grown children, Alexandra, Adriana, and Izabela, who never complained about my absence from family affairs.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction to the Study

Introduction

Adult children, family members, and friends often are left to tend to their aging parents when the parents' ability to care for themselves becomes difficult. Approximately 5.4 million Americans of all ages have Alzheimer's disease; 5.2 million of those individuals are ages 65 years or older (Alzheimer's Association, 2016; Yamagata, Coppola, Kowtko, & Joyce, 2013). The number of individuals diagnosed with Alzheimer's disease is likely to rise to 13.8 million by 2050 (Alzheimer's Association, 2015). Cognitive impairments attributable to Alzheimer's and dementia have an enormous global public health and socioeconomic impact (Duplaga, 2011). Dementia is a progressive cognitive impairment syndrome that gradually advances one's cognitive deterioration (Alzheimer's Association, 2016). Inevitably, changes in health policies, and the adaptation of new policies, related to technological innovation, will continue to accelerate as the number of Americans with cognitive impairments grows.

Given the need for increased levels of sophisticated personalized care, there is a need to intensify the development and deployment of assistive technology (AT) to help organize cognitive and physical maintenance of the frail elderly (Harada, Mori, & Taniue, 2010). Currently, AT includes a myriad of sophisticated gadgets: smartphones, GPS trackers, video and audio technologies, advanced integrated sensor systems, environmental sensors, electronic applications, and programmable medicine dispensers to help the elderly (Hellman, 2012). This study was designed to provide a greater

understanding of how the two worlds of cognitive impairment and AT will converge in the future to impact public policy and administration.

As humans age, physical and cognitive ability decreases. Diminishing abilities may result in frustration for individuals who lose their life skills. However, AT for the cognitively impaired elderly individuals has the potential to improve the quality of care and life, and possibly delay the need for early assisted living (Leung, McGrenere, & Graf, 2011). Examining the use of AT and its influence on the elderly, diagnosed with Alzheimer's, or dementia may lead to positive social change by increasing knowledge among scholars, medical professionals, and laypersons. Such research also offers insight into the perceptions of consumers and rehabilitation and AT engineers who confront the needs of individuals with Alzheimer's and dementia. Lastly, greater understanding and improved implementation of AT could enable the elderly, caregivers, and the state and local governments to save millions of dollars by adopting the new policies (Mpitziopoulos, Konstantopoulos, Gavalas, & Pantziou, 2011). Therefore, AT has the potential to improve the life, self-reliance, and instill pride in the cognitively impaired elderly. This potentially could reduce anxiety in and improve efforts made by caregivers, family, and friends.

Chapter 1 provides an overview of the background of the proposed study, the problem statement, purpose statement, research question, theoretical framework, project design, definitions, assumptions, scope and delimitations, limitations, the significance, and a summary of this chapter.

Background

The need for AT for the cognitively impaired elderly has been widely recognized by scholars and experts in the emerging AT industry. Hellman (2012) documented the rapidly growing demand for AT for the elderly. The U.S. Department of Health and Human Services (2011) estimated that by 2050, some 13.8 million Americans aged 65 years or older will have Alzheimer's disease. Approximately 10% to 20% of individuals over 65 years of age have mild cognitive impairments (MCIs) such as memory and hearing loss, and a declining capacity to perform complex tasks (Harada et al., 2010; Wu, Faucounau, Boulay, Maestrutti, & Rigaud, 2011). The Alzheimer's Association (2016) predicted that more than $1 trillion will be spent in 2050 on this population's health care needs. The potential expense and number of individuals and families affected by impairments related to old age is staggering.

Assistive technology and other parallel health care and maintenance innovations can provide for the needs of the elderly, including those with cognitive impairments. Advancements in technology have created a variety of options for a multitude of lifestyle choices, services, and treatments (Reijonssari, 2013). For instance, AT can be used to alert patients to take their medication or notify them if they have missed a dose. Broadly, AT consists of any equipment, device, or system employed, to increase, preserve, or advance, the functional capacities of elderly individuals with disabilities (Gillespie, Best, & O'Neill, 2012). Collectively, AT and parallel innovations may represent nothing less than a revolution in health care for the elderly.

The future of AT for the cognitively impaired elderly promises the development of innovative health care devices to delay the need for early assistive living and institutionalization with potential growing government liability for Medicare, Medicaid, and health care costs (Leung et al., 2011). However, there is a gap in the literature specifically examining the benefits of using AT by individuals diagnosed with Alzheimer's or dementia. Therefore, this qualitative study was designed to explore how AT may fulfill the daily and functional needs of the cognitively impaired elderly 65 years of age and older with Alzheimer's or other dementia, by 2037. The increasing population of the cognitively impaired elderly has a direct influence on society and demands attention. Expanded Medicare and Medicaid guidelines, and new health policies, are essential to ensure that care taking families of people with Alzheimer's and other dementia are not endangering their health, and financial well-being, by paying out of pocket for illnesses-related costs.

Problem Statement

Among their core job responsibilities, caregivers of the elderly assist individuals with the activities of daily living (ADLs), such as showering, clothing, driving, and eating (Alzheimer's Association, 2015). Many caregivers face low wages, no health insurance, and the cost of transportation to and from the job site (Bureau of Labor Statistics, 2015). Consequently, the employment turnover rate for caregivers is high and recruitment efforts are persistently challenging when seeking to fill caregiver positions such as nurse aides, home health aides, and personal/home care aides (Alzheimer's Association, 2015).

Ongoing efforts are being made to integrate innovative care for the cognitively impaired elderly in the United States. The reason efforts are being made to incorporate innovative care is to offset the decrease in provider-training, and in geriatric care. The need for trained professionals keeps escalating (Alzheimer's Association, 2015). Family and friends care for the elderly with little to no training. Also, two thirds of the 15 million caregivers in the country caring for individuals diagnosed with Alzheimer's disease and other forms of dementia are working women who do not receive any compensation for their efforts (Alzheimer's Association, 2015). According to the Alzheimer's Association (2015), many unpaid caregivers are family members who have chosen to care for their loved ones at home for reasons of obligation, and proximity to the person. They hope to delay their family member's admission into institutional long-term care.

The growth of the Internet and the so-called Internet of things are gradually changing the lifestyles of the elderly who are cognitively impaired. For example, the rise in technology allows for hundreds of websites with online health information sources to give facts about disorders and cures for illnesses (Rifkin, 2014; World Health Organization, 2016). The interconnection of objects, equipped with universal intelligence, leads to a network of devices that communicates with humans as well as with the devices (Xia, Yang, Wang, & Vinel, 2012). Nonetheless, there is a gap in the literature examining the use of AT to assist in providing caregiving support to the cognitively impaired elderly. Although its use among the elderly is on the rise (Duplaga, 2011), the gap between the needs of the sick elderly with what developers of the technologies design, manufacture, and implement, remains to be filled.

Purpose of the Study

This social construction qualitative study was designed to explore alternative futures of AT in aiding the elderly who are diagnosed with Alzheimer's and other dementia. Based on the aim of the study, and the research questions formulated, I took a qualitative approach to enhance the understanding of the phenomenon in its natural environment.

The demographic shifts underway in the United States, as well as the socioeconomic forecasts, have increased interest in the early awareness and management of cognitive impairments in the elderly. Researchers have pointed out a multitude of cognitive aids, environmental sensors, audio and video technologies, and advanced integrator sensor systems to monitor the safety, health, and welfare of the cognitively impaired elderly (Gladman et al., 2012). Thus, attention toward AT for the cognitively impaired elderly is rapidly growing. New AT innovations may improve the quality of care as well as the life quality of the cognitively impaired elderly, and that of their caregivers, particularly when they share the same residence.

Research Questions

Central Research Question

What are the alternative futures of assistive technologies for the cognitively impaired elderly, 65 years old and older, by 2037?

Subquestions

1. What are the implications for major trends in health care services, demographics, and in other major driving forces of change in AT?

2. What are the forces of resistance, myths and metaphors, and narratives surrounding AT?
3. What are the probable, possible, and preferred futures of stakeholders in AT?

Theoretical Framework

The theoretical frameworks for this qualitative study were poststructuralism, principally, deconstruction, and hermeneutics. Poststructuralism argues that power is exercised through literary expression, but that the subtext reveals the essence of who is dominant or hegemonic (Inayatullah, 2008). Hermeneutics is concerned with the power of interpretation and, when applied effectively, generates an understanding of what needs to be interpreted (Silverman, 2013). Inayatullah's (2008) six pillars approach (see Figure 1) to futures studies is grounded in poststructuralism. In this sense, reality is socially constructed, dominated by those who control the power of the word. It confronts this reality and reconstitutes those power relationships.

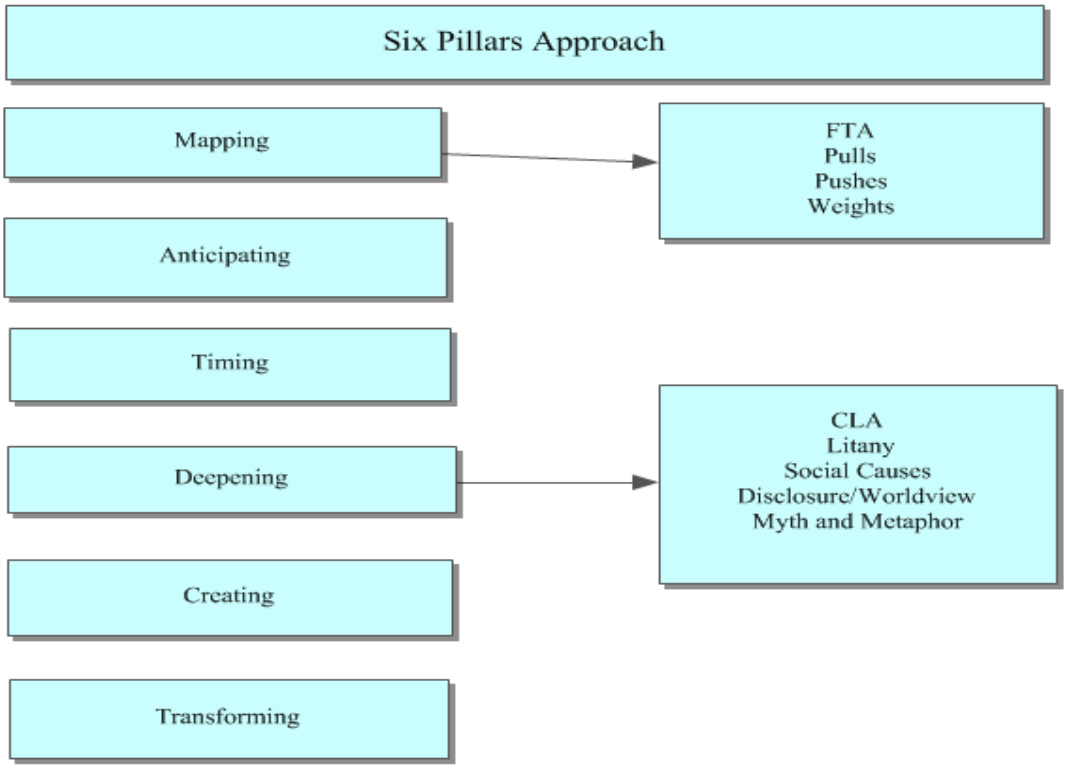


Figure 1. *Six pillars approach*.

Inayatullah's (2008) six pillars approach proposes futurists do the following:

- Map the future with the future triangle analysis (FTA), charting today's interpretations through pulls forward, pushes of today, and weights or barriers to the changes one would like to see (Inayatullah, 2008).
- Anticipate the future.
- Time the future.
- Deepen the future, rooted in causal layered analysis (CLA) with four dimensions: litany, social causes, discourse/worldview, myth and metaphor, which "seek to unpack and deepen the future" (Inayatullah, 2004, p. 12).

- Create alternatives.
- Transform the future (Inayatullah, 2008, pp. 7-17).

Inayatullah's (2008) scaffolding was applied to this project. Broadly speaking, the theoretical construct of poststructuralism supposes that understanding the subtext of power relationships can help us create transformative futures**.** The six pillars approach presented a comprehensive conceptual guide to the futures of AT for the cognitively impaired elderly. Moreover, future triangle analysis (FTA; see Figure 2), served as this study's macro outline, and was introduced through the six pillars. Futures triangle analysis assessed the pushes, pulls, and weights (trends and driving forces) of the future(s) (Inayatullah, 2008).

The analytical framework for this study was CLA, which fostered the critical examinations of texts and articles via four layers of causation: (a) litany, (b) social causes, (c) discourse/worldview, and (d) myth and metaphor (Haigh, 2016; Inayatullah, 2013).

Nature of the Study

In this qualitative research with a focus on data collected in a focus group and questionnaires, I explored the alternative futures of AT for the cognitively impaired elderly, 65 years-old and older, by the year 2037. The data collected were rich and detailed. The intension was to enhance the understanding of the phenomenon in a way that cannot be achieved with quantitative or mixed methods (Berge, 2007). The qualitative approach was designed to explore the social and technological challenges

faced in caring for the mildly cognitively impaired elderly, and to see how the existing technologies could be enhanced to be more useful.

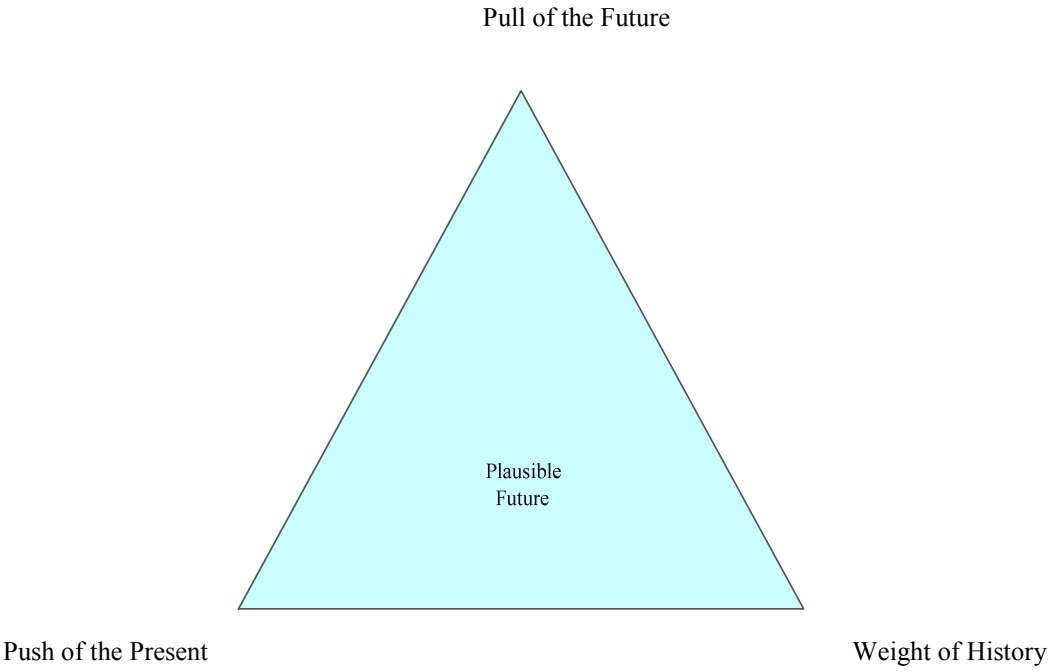


Figure 2. *Futures triangle*.

The first qualitative data were generated from a focus group comprised of seniors from a senior center in New York. The second qualitative component of the overall research design was the output of a website-based opinion questionnaire of trends in the field by AT experts. The third, also a web-based opinion questionnaire from family members of the cognitively impaired. A futures wheel was used to assist in identifying and organizing alternative futures. (Greater detail is provided in Chapter 3.) The focus group data were analyzed using CLA, and generic qualitative analysis of the workshop focus themes. Transcript of the focus group component was transcribed and analyzed thematically to identify meaning and to identify emerging issues by reading the

transcript. I transcribed and analyzed the collected information line by line to identify meaning and categorize arising themes. The frequency was also found by reading the transcribed text line by line.

Operational Definitions

Alternative futures: “There is no single future ‘out there’ to be predicted. There are many alternative futures to be anticipated and pre-experienced to some degree” (Dator, 2009, p. 2).

Assistive technology (AT): "Any item piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of individuals with disabilities" (Technology-Related Act, 1988, p. 126).

Causal layered analysis (CLA): A four-layered analytical structure that permits “creating transformative space for the creation of alternative futures” (Inayatullah, 2003, p. 1).

Cognitively impaired individuals: Individuals diagnosed with mild cognitive impairments, diagnosed with major neurocognitive disorders, and who have trouble, recalling, and acquiring new information, focusing, and in making choices that affect their daily life (U.S. Department of Health and Human Services, 2011). In this study, I used the phrase cognitively impaired elderly to describe all those elderly who are 65 years old and older.

Elderly: Individuals 65 years old or older (World Health Organization, 2010, para. 1).

Future triangle analysis (FTA): A way to plot the competing push, pull, and weight of images of the future (Inayatullah, 2007).

Futures wheel: A way to widen the significance of current issues on "the long-term future" (Inayatullah, 2007, p. 9).

Six pillars approach: A conceptual framework that links methods and tools through praxis via "mapping, anticipation, timing, deepening, creating alternatives, and transforming" (Inayatullah, 2013, p. 45).

Assumptions

In designing this study, I considered four philosophical assumptions: ontological, epistemological, axiological, and methodological. The first, ontology, embraces multiple realities, perspectives, and experiences (Creswell, 2013). The alternative futures approach of this dissertation embodied the ontological approach. Many futures or outcomes are possible, but the future cannot be predicted (Dator, 1983). However, ontology can be a conceptualization of a model of how individuals think about technological devices in their sphere of influence and categorized by their applicable qualities (Prieto-Díaz, 2006). The second, epistemology, is rich in history and serves as an instrument of inquiry based on researchers being close to the participants and their individual views (Creswell, 2013). As a result, subjective data was gathered, based on personal assessments. The third, the axiological assumption, was characterized by reporting my values and biases on information, collected from the research sites (Creswell, 2013). The fourth, methodology, was formed by a researcher's understanding of collected data and accumulated information on the topic being examined (Creswell, 2013). Thus, the future is plural, and

most futurists assume that the future cannot be predicted because of wildcards, countervailing trends, and anomalies. The qualitative research methodology is a collaboration of multiple measures allowing for diverse sets of assumptions (Creswell, 2013).

The research assumptions are declarations believed to be true, but they still must be scientifically tested by the researcher. My assumption was that older adults would be willing to use ATs, and I assume too that older adults with mild dementia could benefit from the use of this readily available technology. There were practical approaches and opinions about the use of such devices. I assumed that they responded to the questionnaire honestly and participated on his or her own accord without any coercion. Thus, alarms, timers, stove safeguards, wearables, smartphones, and memory aids, assumed to be useful for a person with dementia, or for one whose mental abilities are declining, were recognized. Also, I believed that overall wellness was the goal of both caregivers and health care providers. Further, I assumed that majority of persons with dementia lived at home and are being helped by a family member who benefited from AT. I assumed that caregivers benefit from having more free time, and by knowing that their loved ones were being helped. Additionally, I assumed that intrusions into health information could work against the well-being of the elderly with dementia. I assumed that AT products were considered, warranted, and necessary by patients and caregivers and that most devices will become cheaper and shrink in size. They will become more popular with the aging population. Finally, I assumed that great reliance on AT will have consequences for health policy and will impact on the high cost of health care.

Scope and Delimitations

The scope of this study was the elderly with cognitive impairments. AT could delay the need for institutional care. Future researchers can focus on specific technological innovations that can directly or indirectly benefit the cognitively impaired elderly. The scope of this study also included the emerging AT that could delay the need for long-term institutional care or assisted living. Exploring what AT will be like 20 years from now was challenging because of the unpredictability of the AT market and the needs and wants of the cognitively impaired elderly. The delimitations are those properties that constrain the range and outline the borders of a given study (Simon, 2011). Those properties were under the researcher's control, and included the chosen population, research objectives, and theoretical perspectives.

According to an observer, an American health care system with up-to-date technology for the cognitively impaired elderly, along with minimal out-of-pocket expenses is needed, and worth investigating (Buhler-Wilkerson, 2007). This study, however, was restricted to exploring AT for the cognitively impaired elderly.

The aim of this study was to examine AT that will help the cognitively impaired elderly. Subjects under 18 years old or judged incapable of giving consent were excluded (Vorm & Rikkert, 2008, p. 85). This study's participants were the family members of the cognitively impaired elderly, seniors, and AT engineers. As a result, different viewpoints were documented. It is also possible for different family groups, seniors, and AT engineers to yield different results. The research design applied in this study consisted of "multiple theoretical perspectives to examine and interpret the data" as recommended by

Guba (1981, para 3). Thus, all measures were taken to ensure credibility and dependability. Participants were informed that they had the right to withdraw from the study at any time without consequence.

Limitations

Qualitative researchers over the years have produced reliable results in different research projects. Researchers have noted that the dynamics of qualitative research may be problematic. The futures studies limitations come from the unpredictability of the future. There are numerous methods that can be employed to examine the future. They include environmental scanning, text mining, futures polygon, and trend impact analysis, cross impact, wild card, structural analysis, systems perspectives, decision modeling, substitution analysis, technology sequence, morphological analysis, relevance tree, scenarios, and numerous other methods **(**Glenn, 2009).

This research centered on three methods: causal layered analysis, futures wheel, and the questionnaire. The causal layered analysis can be thought-provoking to those who reject the subjective in their physical surroundings. The causal layered analysis has its limits. It is a new method and may be used in union with other methods. It is especially difficult applied to those who see the world as true or false, right or wrong. Dialogue must be interactive because moving between the layers spawns several conversational outcomes. The litany, social causes, discourse/worldviews as well as myths and metaphors are enhanced by these firsthand experiences. However, they may be rejected by those with one worldview. Nonetheless, causal layered analysis has been effective in focus groups over the last several years (Inayatullah, 2008).

Another limitation came from the use the futures wheel. Like the questionnaire, it is only as good as the collective judgments of the study participants. The participating group may think they understand the causal relations between the emerging themes when they do not. The futures wheel may be simplistic, and unable to determine impacts and consequences. However, the harvest of the futures wheel can be used as a foundation for further exploration and thinking.

The limitation of the questionnaire method is in getting AT experts to participate. The additional limitation has been in motivating participants into meaningful argumentation. To resolve that problem, 10 to 15 professionals can be questioned ahead of time either by telephone or email. Its strength is its speed, flexibility, lower cost, and central organization.

Creswell (2013) stated that limitations come from two main areas: "the chosen methodology and the studied population" (p. 366). Furthermore, when conducting qualitative research, it is important to ensure that contextual, and descriptive information, is transferable to provide an understanding of the study (Shenton, 2004).

The aim of my study was to explore assistive technologies that may help the cognitively impaired elderly in the year 2037. That was accomplished by generating data from a focus group at a senior center in New York, as well as questionnaires with family members of the cognitively impaired elderly and the Engineering Society. The focus group participants may have brought inaccurate answers because of their lack of experience with AT. Finally, the results of the web-based questionnaire could have been distorted when obtained from the family members of the cognitively impaired elderly and

the AT engineers. Limitations may have stemmed from a limited number of participants. Also, it is difficult to apply the results to a wider population. However, CLA, with its four layers, helped integrate divergent assessments and beliefs, bringing the application to a wider population, will make it less challenging.

Acknowledging and safeguarding this research study was achieved with digital recorders. The focus group, and the line of questioning, pursued in the data-gathering sessions resembled one used by Shenton in 2004. Purposeful sampling diminished bias (Shenton, 2004). The trustworthiness of this study was addressed by recording the facts under study with two digital recorders. Peer debriefing ensured that the conclusions were grounded in the data. I facilitated the focus group and was assisted by a note-taker. The focus group transcripts were reviewed by me and the note-taker for accuracy. Only I had access to the verified and triangulated data.

Significance of the Study

Although dementia occurs predominantly in high-income countries, by 2050 more than 70% of the cases are expected to be present in low- to middle-income countries (Scommegna, 2012). The burden of caring for patients with dementia will likely fall on a female family member, who is already overworked and not paid for her efforts (Gawande, 2014).

Technology has been implemented and used in education, corporations, large and small, and in financial institutions, and in hospitals. The benefits of technology are many, but its implementation for the cognitively impaired elderly needs to be explored further. Researchers have suggested that early intervention can ease the duties of those caring for

individuals with dementia by incorporating AT into their lives (Granada et al., 2010; O'Neill & Gillespie, 2012). There is an urgent need to recognize when and how persons with dementia, and their caregivers, can benefit from AT.

The failure to implement new and effective health care policies that address transformative technologies leaves the nation unprepared for an upcoming epidemic of Alzheimer's and other dementia (Alzheimer's Association, 2015). Carlo (2014) argued that without adequate AT use, policies and laws, profound social, financial, and legal frictions will be created. Public policy on the use of AT should be focused on the quality of life for all human beings, particularly the cognitively impaired elderly. The significance of this study was also evaluated by a move away from assisted living and long-term care facilities to technologically modifying homes (Duplaga, 2011).

Technology has had a multifaceted connection to our society. Dator (1983) suggested three ways of examining technology: "as mere tools, anti-human objects or technology that changes humans as they modify technology" (pp. 29-30). Inayatullah (1997) viewed technology as a divider of the rich and the poor, the slow, and the quick, a world void of mysticism and spirituality, based on capitalism. Dator (1983) and Inayatullah (1997) explained that technology brings complexity to the world. Calo (2014) called for the creation of the federal robotics commission because robotics, AI, and AT, have fundamentally different attributes that the law has yet to confront. There are still many unanswered questions about our connection to technology, but one answer is sure, society is connected to technology physically, and emotionally. Technology is not neutral. Societies" relationship with technology is an unprecedented union. The

innovations in AI and AT are shaping global policies, economic growth, and human interactions.

The worldwide declining fertility rates and long lifespans are leading to under-population and a multitude of cognitive disorders (United Nations, 2015). Thus, it would be beneficial to broaden the discussion about the future of AT, for promoting independence, and delaying the need for institutional long-term care (Rechel et al., 2009). If the shortage of caretakers continues to be ignored, communities will face additional uncertainties for their loved ones and for themselves.

Summary

Anticipated higher rates of dementia by 2050 will fall on family members. Incorporating AT and early interventions can reduce the duties of those caring for elderly individuals with dementia. There continues to be a need for new health policies and a move away from communities, such as assisted living and long-term care facilities, toward technologically modified homes. If the scarcity of caretakers remains, our communities will face additional uncertainties for their loved ones and for themselves.

The problem this study aimed to address was the quality of life for the impaired elderly. This study explored pathways toward the adoption of technologies. The research question: What are the alternative futures of AT for the cognitively impaired elderly, 65 years old and older, by 2037? I explored future applications of AT in aiding individuals 65 years old and older diagnosed with Alzheimer's and other dementia as well as with applications concerning tasks associated with accomplishing the shortage of available caretakers.

Poststructuralism, principally deconstructionism, and hermeneutics were the theoretical frameworks, governing this investigation. Inayatullah's (2008) six pillars approach to futures is grounded in poststructuralism and acted as a guide for this examination. Future triangle analysis served as a macro outline that assessed the pushes, pulls, and weights of the futures. The causal layered analysis was the analytical framework that examined texts and articles via four layers: (a) litany, (b) social causes, (c) discourse/worldview, and (d) myth and metaphor. The study was designed to understand the social aspects of challenges, faced in administering care, as well as in technology's use and enhancement to benefit the elderly. Key definitions were provided, and the scope and limitations of the study were addressed.

In Chapter 2, I reviewed the scholarly studies connected to AT, and to the theoretical foundation of poststructuralism. In Chapter 2, I also discussed the history, traditions, barriers, and the technological innovations involved in my study.

Chapter 2: Literature Review

Introduction

Rapid advancements in AT has changed the lifestyles of the aging population. The average elderly age at the beginning of the 20th century was between 60 and 70 years (Roszak, 2009). The projected life expectancy for females in the United States in 2050 will be between 84.9 and 88.4 years of age, and for men between 79.5 and 83.8 years of age (Population Reference Bureau, 2002). Longer life spans forced the need for new technologies to confront the deficiencies currently in technology and health care. Predicted shortages in geriatric health care have also influenced growth in technology and in industries such as human services, and home health care for the elderly (Warshaw & Bragg, 2016). Assistive technology has helped plan and execute daily living activities such as receiving a dose of medication. This technology is especially significant for older adults with cognitive impairments who lack human support but who want to live independent lives. The cognitive impairment of the elderly, commonly known as dementia, will affect an estimated 13.8 million Americans by 2050 (Alzheimer's Association, 2016, p. 23). The effect of this disorder will change both the technology and the health policies in use.

This chapter outlined the search strategies and databases used to conduct a thorough review of the study's theoretical framework, population, and critical variables. Chapter 2 concluded with a summary of the information presented throughout the chapter.

Literature Search Strategy

The literature search was conducted using the libraries at Walden University, Queens College CUNY, and Bellevue/NYU. Databases included ProQuest Central, Academic Search Complete, ScienceDirect, and Google Scholar. The broad scope of the review included scholarly literature and research on the emergence of the greater use of AT for the cognitively impaired elderly. In addition to academic sources, other sources used blogs, corporate reports, and forums. The primary keywords and key phrases for this study included: *assistive technology*, *future assistive technology*, *elderly*, *longevity*, *health care*, *health providers*, *health policy*, *HIPPA*, *Alzheimer's disease*, *dementia*, *cognitive impairments*, *cognitively impaired elderly, gerontology*, *assisted living*, *independent living*, *six-pillar approach*, *causal layered analysis*, *futures triangle analysis*, *poststructuralism*, *deconstructionism*, *hermeneutics*, *home health care*, *home health care aids*, *elderly care provider*, *assistive technology devices*, *assistive technology device for the elderly*, *assistive technology device for the cognitively impaired elderly*, *assistive technology innovation(s)*, *social construction*, *person with dementia*, *artificial intelligence*, *alternative futures*, and *qualitative research methodology*.

Theoretical Foundation

Poststructuralism, mainly deconstructionism, and hermeneutics, provided the theoretical foundations for my research. Poststructuralism gained its prominence in the 1960s and 1970s (Bensmaïa, 2005). The French and other continental philosophers, such as Derrida and Husserl (as cited in Bensmaïa, 2005), responded to structuralism, and formulated it, arguing that culture may be valued by measures of structure and self-

sufficiency. Poststructuralism, closely related to existentialism, maintains that there is an inherent instability in the human sciences (Bensmaïa, 2005). Poststructuralism rejects the notion that a literary text contains a single purpose or meaning. Instead, the reader is said to derive individual rationale and meaning from a given text. Poststructuralism presented a theoretical framework, and a fundamental vocabulary, to understand the structure and information of technology (Tredinnick, 2015).

Deconstructionism is closely tied to poststructuralism. Derrida introduced this method of analyzing the text in the late 1960s (Bensmaïa, 2005). Derrida (1976) reasoned that language is fundamentally unstable and that the reader, not the author, determines the meaning. Deconstructionism determines the final meaning in a text. The meaning of a given text is based on a language assessment. The method challenges the conventional assumptions of gender, race, economics, politics, and culture (Derrida, 1976). Deconstructionism is defined as a way of analyzing literature, and in assuming that words cannot have a predestined meaning (Derrida, 1976).

Modern hermeneutics is also a dominant model in continental philosophy. It refers to verbal and nonverbal communication, "semiotics, presuppositions, pre-understanding, and interpretation" in science and literature (Grondin, 1994, p. 2). Routhbard and other intellectuals considered this theory of interpretation nonsensical. They claim that jargon dominates the text in which objective truth cannot be found (Grondin, 1994). Still, hermeneutics appeared even in Aristotle's work on Interpretation circa 360 BC, one of the earliest works to deal with relationships between language and logic (Grondin, 1994). For almost two centuries, theorists, such as Heidegger, Husserl,

Dilthey, Ricoeur, and notably Schleiermacher, brought hermeneutics into the modern spotlight by transforming the long-established Biblical hermeneutics into universal hermeneutics that integrates conversation, written words, and texts of all types (Rutt, 2006).

Studies about the future have been grounded in interpretive or hermeneutic theory, which holds that political life is a social creation. Hermeneutics also holds that fundamental and universal values should be honored, unlike poststructuralism, which posits that there is *no there, there* (Mantzavinos, 2016). Hermeneutics, in contrast to poststructuralism, is a normative framework. That framework emerged in futures studies in Europe and the Asia-Pacific region (Jones, 1992). As a result, Inayatullah's (2008) analytic approach was chosen for this study because it overlaps with the hermeneutic approach. In this study, future triangle analysis (FTA) was the macro outline that evaluated pushes, pulls, and weights. Causal layered analysis (CLA) served as the analytical structure that examined texts and articles. Poststructuralists' views of Derrida (1976), Husserl (1973), and other continental philosophers underlined their analytical approach.

Lifespan and Longevity

The U.S. population's lifespan is growing dramatically (Alzheimer's Association, 2016). Age does not correlate with demographics traditionally used as a measure of population and society. Scholars from the International Institute for Applied Systems Analysis (2013) declared that the number of years one has lived doesn't reflect his/her cognitive, physical, or behavioral capacity. Sanderson and Scherbov (2013) showed that

even life insurance policies depend on the health characteristic of the people being insured. Functionality is the most realistic measure of aging.

The increase in human longevity has also altered the relationship between the young and the old. Gawande (2014) declared that elders no longer own "knowledge and wisdom" (p. 18). Thanks to continuous technological advancements, age has lost its value. Today we turn to Google, and if we have problems with our personal computers, we ask a teenager for help (Gawande, 2014). Traditionally, surviving parents offered strength, guidance, and security to younger families. The child who cared for his parents inherited the estate, ranch or farm, but with extended lives, matters are strained. The family arrangement has become less a cradle of security and more a push for control over finances and property (Gawande, 2014). In 2017, the elderly are aware of those problems and many show interests in the environment, and in financial security for their families, health policies, and in their own health.

Age Cohort Inquiry

American writer, presidential advisor, and a former secretary of commerce P. G. Peterson (1999) predicted global aging would become a pivotal socioeconomic topic for the 21st century. After World War II, America experienced a significant baby boom. Baby boomers control more than 80% of personal financial assets, and more than half of all consumers spending (Peterson, 1999; Gillon, 2004). They buy 77% of all prescription drugs, 61% of over-the-counter drugs, and 80% of all leisure travel (Gillon, 2004). One third of the baby boomers do not save, or contribute to their retirement (Peterson, 1999, p. 123). This situation is not much better outside of the English-speaking countries. Only

Denmark, the Netherlands, and Switzerland have founded private pension systems that cover half or more of their workforce (Peterson, 1999, p. 124). The remaining employers in continental Europe contribute little or nothing to the pension plans of their employees. In the United States, the rising cost of medication, outpatient, and inpatient services amplify the situation. Medical tests and medications are given too much, which escalates the costs of health care (Gawande, 2014).

Despite all these obstacles, baby boomers are pushing to increase the sales of equipment. Boomers remind the technology companies and retailers that guarantee, and warranty programs work well with the older generation (Gilmartin, 2015). They advocate for connectivity among family, and friends. They push for control in the lives of the elderly, promote independence, and advocate delaying institutional long-term care (Roszak, 2009).

The baby boomers are privileged to be one of four generations that have experienced substantial socioeconomic and technological changes. The Silent Generation, successful and enmeshed in their professions and family life, did not grow up with today's technology (Rosen, 2004). The baby boomers were the first generation with computers, followed by Generation X, which became more computer literate, and the Net Generation Y, which became proficient with video games, the Internet, and different computer systems (Rosen, 2004). On average, baby boomers prefer routines, face-to-face interaction, and having one job during their professional lives (Rosen, 2004). Generation X is spontaneous, challenges authority, prefers electronic communication, and holds several jobs throughout their working careers (Rosen, 2004). The Net Generation Y

Americans are interwoven with technology before kindergarten and communicate more on instant messaging than in any other way. They tend to get bored quickly and change jobs often (Rosen, 2004, p. 3). Thus, economic, technological, and regulatory changes over the past several decades have changed the way we live and think.

The Silent Generation, born between 1925 and 1945, unlike the boomer generation, did not talk about changing the system but of working within the system (Howe, 2014, para 3). They benefited from jobs that offered good wages, signed up early for pensions, bought stocks and bonds while the market was strong, and sold them just before the crash struck (Howe, 2014). The silent generation is the fittest and most accomplished generation of elders that have ever lived (Howe, 2014). Now in their 70s and 80s, Silent Generation comprises about 20 million adults with well-defined benefit pension plans and high savings. Howe (2014) noted the silent generation was never considered a powerful generation, but their members are known for their interest in helping others, particularly their grown children and grandchildren.

The baby boomer generation was born in the United States between 1945 and 1964 and represents a population of about 76 million Americans (Green, 2006). This large group is significant not only because of its size but its uniqueness. Its distinctiveness is marked by the demographic, economic, political, and social changes that it has endured. The generation is also characterized by a clash between conservatives and liberals, an economic roller coaster, inequality of pay, and a lower standard of living. Coughlin (as cited in Gilmartin, 2015), director of the AgeLab at the Massachusetts Institute of Technology, argued that baby boomers are not new to technology.

Gerontocracies are not the chosen elder rulers and they do not threaten the sales of smartphones, HDTVs, or other technological gadgets. Boomers have embraced wearable devices, tablets, and iPads. The baby boomers' assets are substantial and growing. They can afford to splurge on computers and assistive devices, which suggests market gains for manufacturers, wholesalers, retailers, and the health care industry (Gilmartin, 2015). The baby boomer generation is pressing for technological transformation, asking not for bells and whistles but for tools that will make their lives simpler, more attractive, and comfortable.

Toossi (2012) in the Office of Occupational Statistics and Employment Projections of the Bureau of Labor Statistics predicted that by 2020, 47.3% of all U.S. workers will be 55-year-old men, 57.1% women. This age bubble implies that there may be a financial and economic slowdown as the baby boomers continue to retire. Peterson (1999) believed that the developed world's population would peak by 2020, and then fall significantly in numbers (p. 50). The assumption of a peaking global population is reasonable, considering women average less than 2.1 births per lifetime (Peterson, 1999, p. 50). The world's population prognosis, conducted by the world's leading demographers, project that the world's population will peak by 2070 (Huntington, 1996). The gap between the two forecasts reflects the difference between the young developing world, and the developed countries (Peterson, 1999). The U.S. Census Bureau's 2014 National Projections (as cited in Colby & Ortman, 2015) also estimated that the U.S. population would "grow more slowly in future decades than in the recent past as these projections assume that fertility rates will continue to decline" (p. 1).

Thus, the future U.S. workforce will decrease considerably while the cost of medical equipment, medication, inpatient and outpatient services will rise. There is a need to curtail medical expenditures. Lowering costs can be accomplished by turning today's smart devices into tomorrow's personalized miniature electrocardiograms (ECG) or electroencephalograms (EEG) that can instantly produce low-cost, accurate test results for all people, preventing costly and often unnecessary hospital stays.

Health Policies

Suitable health policies rest on understanding present problems in the U.S. health care system. The industry ranks among the least policy stable when compared to its counterparts among the developed nations. U.S. health care policies are in a continuous state of fluidity (Vitalari, 2016). Health policy implementation is influenced by inefficiency, contentious politics, and interest groups, divisions in corporate models and procedures, and unequal distribution of earnings. However, the Affordable Care Act (ACA) of 2010 allowed over 20 million previously uninsured people to be insured and young adults to stay as dependents on their father's or mother's health insurance up until age 26 (Sommers, Buchmueller, Decker, & Kronick, 2013). There continues to be an increasing need for assistance for specialized groups of individuals with disabilities, such as the elderly with cognitive impairments.

Thus, the passage of the ACA did not solve all the problems but allowed key strategists and decision makers to reexamine legislation. Consequently, these contradictions can and will give rise to future opportunities and alternatives. The transitioning process from central to universal construct, biological physiognomies of

individuals, and the worldwide distribution of innovations, is the noticeable elements of future health care (Vitalari, 2016). These factors may contribute to the collaboration and transparency among industry competitors but can also be the forces off resistance. Nonetheless, the U.S. health care will have the opportunity to shift from a push standard to a pull paradigm shaped by personal demands.

Health care fragmentation leads to an uneven assessments and pricing that in turn leads to difficult cost evaluations on care options, such as out-of-pocket elective procedures or simple asthma treatments. ACA may not be the perfect solution to the range of U.S. health care glitches, but its changes have allowed for Medicaid expanded coverage that includes preventative care, coverage to those with pre-existing conditions, and no "lifetime caps on insurance benefits" (Vitalari, 2016, p. 4). The law also identifies several reforms to Medicare, specifically the shift from "fee for service payments" to "bundled payments" (Vitalari, 2016, p. 4). As well as the use of an Independent Payment Advisory Board (IPAB) to propose changes to Medicare to stimulate the implementation of cost-saving procedures, and the delivery of care at a local level (Vitalari, 2016, p. 4). Specifically, the ACA dictates information sharing and collaboration among the key participants in the industry, which may result in the advantageous passing of laws and policies, benefiting the nation.

The hope was that the ACA would also bring about a new assortment of information technology and interconnection to current and future systems of health care informatics, such as medical records or therapeutic data. Additionally, the ACA was going to move third parties to present a wide range of accompanying services like mobile

and personal health gadgets (Vitalari, 2016). These new mandates were likely to inspire more innovation and new growth in medical technology.

Regrettably, support for the ACA declined. The key requirements were deferred or defunded. The changes can be attributed to a 45% cost increase since 2010 for its implementation (Vitalari, 2016). Furthermore, the ACA was not designed for quick modifications. For these reasons, the future of the ACA is uncertain in today's legislative and political setting.

A new approach to care must emerge and should be driven by health professionals, consumers, and health care pro-consumer policies, as well as to care for providers who use new and improved technologies. In this view, health care should not be about profits. In this view, it should be collaboration between consumers, health care professionals, and technology, supported by a global network of specialists. In the future, the acute care doctors, neighborhood clinics, and nontraditional care providers, will be connected via transferable and readily accessible electronic health records. Technology will enable health care professionals to interconnect and to instantly collaborate with other providers around the world to deliver care.

The cost of care can be and will be diffused by "low-cost and high-speed, sequencing of individual whole human genomes on a global basis" (Vitalari, 2012, p. 10). By 2037, human genomic data and macrobiotics data will allow for an individualized model of care lasting the individual's entire lifetime (Vitalari, 2012, p. 10). The use of genome sequencing can spearhead the new emergence of a holistic, individualized, model of care with an emphasis on total physical and mental soundness.

In America, the health industry is still manipulated by powerful financial and economic interests such as the pharmaceutical industry, insurance companies, hospitals, and doctors. The reason is obvious; these are for-profit institutions that can set prices as they think necessary for their growth. Health insurers can increase prices for patients with undesirable traits and set high copays and deductibles. The so-called catastrophic policies with low premiums can have a "deductible of up to $11,000 per family per year" (Poplin, 2012, p. 108). Insurers can also structure benefit packages to entice only the desirable clientele. Providers and insurers behind closed doors negotiate health care prices for services. The result depends on the strength of the negotiator. Therefore, if the insurer has a substantial number of beneficiaries, that insurer can dictate the price of hospital services. A respected in-network hospital can demand high rates for services. The pharmaceutical companies that produce specialized medication can charge insurers more than of $100,000 per year per patient (Poplin, 2012, p. 108). The cost for all these transactions is enormous, and only the government can set controls and end the exploitation of ordinary citizens by the for-profit giants.

The access to global banks of information, augmented by artificial intelligence, can and will help in lowering the costs of care and the pursuit of total wellness. Thus, policy makers will have to adjust premiums to wellness objectives and outcomes, while being attentive to the protection of privacy and individual freedoms. The social good in a global multicultural society will transform health and health policies the way today's technology has helped us obtain instant, new information, from around the world.

Undoubtedly, health policies will be deliberated and contested for many years to come, but one thing is sure, the current policy structure will soon be outmoded.

Medicare, the nation's first universal federally funded coverage, went through several evolutions. When enacted in 1965, Medicare covered a quarter of hospital costs (Fried, 2015). Today, 93% of Americans age 65 and older, and 5.6 million people with disabilities, are covered by Medicare Part A with deductible for each benefit period (U.S. Department of Health and Human Services, 2012). Soon after Medicare was legislated, graduate medical education, beneficiaries with chronic diseases, option of Medicare Part B for outpatient care, home health services, hospice care, Medicare Advantage Part C, capitated hospital and outpatient care with potential access to pharmaceutical care were added along with psychiatric services. Other services can be covered as well (Fried, 2015, p. 181). Medicare is establishing chronic disease management and prevention in community settings to deal with a future primary, a secondary and a tertiary progression of conditions. The expansions of services provide financial protection from the cost of health care.

Ultimately, the goal of Medicare, Medicaid, the ACA, private or any other future health coverage will be developed for the U.S. population. The changes will be systematic and will integrate existing well-functioning policies that include preexisting conditions but are based on prevention and wellness. The goal of health care policies should be to manage illnesses and disabilities, optimize autonomy, provide the best medical care possible, and support the aging.

Along these lines, government-backed universal health programs work efficiently in Canada and on the European continent. In Belgium, a combination of public-private health platform has created a health ecosystem that is accessible to all of its citizens. But uncontrolled and unregulated technology allows intruders/hackers to break into private medical records.

All countries face similar health policy challenges. They come from changing technology, and medicine due to the aging population (Burau, 2012). These changes must embrace policy adjustments without being grounded in the path of policy dependence (Burau, 2012). In the United States, the Portability and Accountability Act (HIPAA) granted patients the right to examine and amend their paper medical (Wachter, 2015). When HIPAA became law, electronic medical records (EMR), personal health records (PHR), health portals, smartphones, and global connectivity were not available. Only the selective laws were applicable (Wachter, 2015).

Over the last 20 years, the discipline of health policy, HIPAA, and its subjects have undergone multiple changes. Health policy has become a well-established field of study and research (Bureau, 2012). The challenges came from the new approaches to health care, the practice of medicine, and a rapidly changing technology. In this country, those transformations are greater now than ever. An introduction of EMR and easier access to PHR has transformed the private to the public. The challenge of protecting personal identity and the patient medical information is now global.

Since August 21, 1996, HIPAA has governed the safety of patients' health information (Wachter, 2015). It has been essential in protecting the privacy of those who

cannot protect themselves. However, HIPAA laws were not always well received or immediately accepted. Wachter (2015) noted that doctors, who pinned children's pictures to corkboards were, in effect, displaying safeguarded health information and were in violation of HIPAA (Wachter, 2015). The question of protecting PHR remains a problem. Advances in technology make it easier for hackers to intrude on corporate and private lives. One way to protect patients' information is to apply stringent rules as was done at the New York City's Health and Hospital Corporation (HHC). "The Need-To-Know" standard emerged years after many breaches of patient's health information. It reads as follows:

> HHC has established policies and procedures to safeguard protected health information (PHI) by limiting access to only those workforce members who require it, and only to specific PHI that they need to carry out their assigned job functions. If you have access to PHI, you may only use and disclose PHI to fulfill a function of your job. You cannot use your access privileges to obtain information "out of curiosity" for yourself or anyone else or to obtain information as a favor for a friend or family member. This includes entering into the medical record of a patient whose treatment in which you are not involved. Even in cases where your access to PHI is appropriate, it is your responsibility to ensure that any further disclosure of PHI by you is made only to those who also have a need to know and is restricted to only the minimum necessary. If you suspect a privacy or security breach, you should report it to your supervisor and the Facility Privacy Officer. (Bellevue Public Relations, 2015, para. 4)

However, a disclosure of personal information even in a well-protected health care facility can occur unintentionally or deliberately. No matter how it happens, the harm to the individual is usually immeasurable (UC Davis Health Systems, 2010). Its implications reach well beyond the physical health of that person and can include loss of a job, alienation of family and friends, and public humiliation.

Cognitive Impairments

Mental health diagnoses are based on sets of criteria, established by a team of professionals, and determined by qualified mental health practitioners. The commonly recognized manual that classifies mental health disorders is the *Diagnostic and Statistical Manual of Mental Disorders (DSM).* The goal of the *DSM* is to provide well-defined descriptions of diagnostic categories to enable clinicians and investigators to diagnose, communicate on their studies, and to treat people with various mental disorders (Galileo Scholar, 2011, para. 3). The *DSM-5* is the current version of the diagnostic manual used by health care professionals and researchers to categorize mental disorders (American Psychiatric Association [APA], 2013). Mental health impairments, specifically neurocognitive disorders, can range in levels of severity from mild to severe.

Individuals diagnosed with mild cognitive impairment might detect changes in cognitive functions, but they are still capable of doing their everyday activities (Marshall, Amariglio, Sperling, & Rentz, 2013). Severe levels of impairment can result in losing the capacity to comprehend the importance of something and the loss of faculty to talk or write, leading to the inability to live healthy and independent lives (U.S. Department of Health and Human Services, 2011). Severe levels of impairment can result in losing the

capacity to comprehend the importance of something and in losing the ability to talk or write, resulting in the inability to live healthy and independent lives (U.S. Department of Health and Human Services, 2011).

Categories of Cognitive Impairments of the Elderly

This study focused primarily on the cognitively impaired elderly. Such individuals age 65or older have afflictions, ranging from mild NCDs to major NCDs. Developed countries accepted the chronological age of 65 years as being elderly (World Health Organization, 2010, para. 1).

Additionally, the *DSM-5* identifies a less acute level of cognitive impairment, mild NCD, a disorder that allows for the identification of less incapacitating conditions that may be at the core of concern and treatment (American Psychiatric Association, 2013b). This study used both the old and newer classifications of MCIs, and major NCD. Diagnostic standards were set for both major NCD and mild NCD, followed by diagnostic criteria for other subtypes (American Psychiatric Association, 2013a). While the base between mild NCD and major NCD is subjective, there are fundamental reasons to treat these two stages of deficiency independently (American Psychiatric Association, 2013a). The major NCD syndrome delivers uniformity in the field of medicine, and the earlier DSM editions ensure continued care for this group (American Psychiatric Association, 2013a). Even though the mild NCD syndrome is new to the *DSM-5*, its manifestation is consistent with its usage in medicine with its unique focus on research and care, particularly for those with Alzheimer's disease (American Psychiatric Association, 2013a, para. 77).

Dementia and Alzheimer's disease

Dementia's Causes and Characteristics

Dementia is a term that refers to several conditions. It is an NCD rather than a disease. Dementia denotes malfunctioning of the brain such as recall, language, behavior, and unobstructed thinking (Alzheimer's Association, 2016). Dementia is a condition, characterized by the impairment of memory and one other ailment in the cognitive domain like aphasia, apraxia, agnosia, and executive function (Alzheimer's Association, 2016). However, dementia can be caused by other less common conditions such as vascular dementia, previously known as post-stroke or multi-infarct dementia. It may coexist with Alzheimer's disease. Dementia with Lewy bodies, or DLB, has symptoms in common with Alzheimer's. These include sleep disorders, visual hallucinations, gait imbalance, and memory impairment (Alzheimer's Association, 2016). Frontotemporal lobar degeneration FTLD is a behavioral and personality difficulty with language complications. Memory is spared in the initial stages of the illness. Mixed dementia is Alzheimer's combined with vascular dementia and with DLB is less common. Parkinson's disease (PD), a form of dementia, is a problem with movement. Creutzfeldt-Jacob disease affects memory and coordination and results from misfielded protein and its malfunction. Normal pressure hydrocephalus comprises walking difficulty, memory loss and the inability to control urination (Alzheimer's Association, 2016).

Alzheimer's disease is the most common form of dementia. It is the slow "accumulation of the protein fragment, beta-amyloid (called beta-amyloid plaques), outside neurons, and the accumulation of an abnormal form of the protein, tau, which is

believe to contribute to the distraction of neurons, resulting in memory loss and in other Alzheimer's symptoms (Alzheimer's Association, 2016, p. 9).

This detailed classification of the stages of Alzheimer's shows the differences that exist among the cognitive impairments in the elderly. In 2013, the *DSM-5* recognized the newly named unit major neurocognitive disorder (NCD), and the mild neurocognitive disorder (NCD). However, the term dementia with its seven clinical stages has not been excluded from the standard usage, and its known classifications to include normal, normal aged forgetfulness, mild cognitive impairment, mild Alzheimer's disease, moderate Alzheimer's disease, moderate Alzheimer's disease, moderate severe Alzheimer's disease, and severe Alzheimer's disease (Fisher Canter for Alzheimer's Research Foundation, 2014).

Alzheimer's disease, Causes, and Characteristics

No single test can diagnose dementia or Alzheimer's disease. Topol (2012) and others reported difficulties in diagnosing Alzheimer's disease and other forms of dementia. Several approaches are used to make a diagnosis beginning with obtaining a medical and family history, asking family members to provide feedback about changes in behavior and skills. Seeking input from a neurologist, conducting physical and cognitive tests, and undergoing magnetic resonance imaging (MRI) scan to identify possible brain changes are also used. When making a diagnosis, physicians might also refer to the *DSM-5* (Alzheimer's Association, 2016). In 2010, the discipline of geriatrics went through advances in "imaging and biomarkers" (Topol, 2012, p. 131). That means that the use of brain imaging and other biomarkers could be the foundation for selecting new drug

treatments (Topol, 2012). Prevention may be the key to intervention for Alzheimer's and other dementias. Appropriate interventions can improve the quality of life for the elderly with dementia.

Treating Individuals Diagnosed with Dementia or Alzheimer's disease

Multiple conditions contribute to dementia. Treating the condition includes using drugs, treating tumors, metabolic disorders, and hypoglycemia caused dementia (Alzheimer's Association, 2016). Some pharmaceutical treatments those that increase the number of neurotransmitters only temporarily improve the condition. On the other hand, none of the treatments stop the damage completely, making it a fatal disease (Alzheimer's Association, 2016). Nonpharmaceutical treatments, such as reminiscence therapy or music therapy stimulate recall, but they do not halt the progression of Alzheimer's disease (Alzheimer's Association, 2016). Nonpharmaceutical therapies are frequently used to enrich the quality of living by reducing depression, sleep disruption, apathy, wandering, agitation, and aggression (Alzheimer's Association, 2016). In randomized studies, activities such as gardening, listening to music, and word games, show potential to help. Additional research on nonpharmacologic therapies is needed to assess their effectiveness (Alzheimer's Association, 2016).

Elder Caretakers and Medical Care.

The intricacies of elder care caused a decline in specialized and nonspecialized geriatric service. The number of doctors, physician assistants, registered nurses, social workers, and caseworkers, who specialize in elder care, has declined (Alzheimer's Association, 2015). By 2030, the United States will need an additional 3.5 million health

care professional just to keep up with the current number of elderly patients (Alzheimer's Association, 2015). Thus, more geriatricians, and trained geriatric professionals, are needed for a rapidly growing elderly population with an increasing number of mental disorders.

The 1990s brought changes in the way elderly consumers saw the abilities of their physicians (Topol, 2012). The changes came from developments in policy, technology, and society. Reimbursements from health insurance companies dwindled. Longer hours were needed to sustain a private practice. Many doctors opted to work in hospitals or on research only. The number of physicians in private practice has declined (Topol, 2012). As people became more comfortable with the Internet, and the availability of health information grew, the list of questions for a health care provider also grew.

Labor shortages in many disciplines, and in the supportive medical fields, grew. Traditionally, women family members provide the care by "volunteering" for that unofficial occupation (Roszak, 2009). This inexpensive solution was not an ideal solution for a middle-class family. It could negatively affect the care and create resentment towards the older adults in need of it (Roszak, 2009). Changes in the way we care for seniors evolved over the past century. In the past, families did not have to oversee the administration of multiple medications and injections, take stool samples, prepare gluten free foods, offer aerobics, dress and groom seniors, and deal with dementia. However, the growing numbers of childless couples, and the longevity of the baby boom generation adversely influenced the future health care costs (Roszak, 2009). In the 21st century, women were again victimized, predominantly women from ethnic minorities. Most

earned the minimum wage without benefits (Roszak, 2009, p. 100). The goal of keeping older people alive and well has become the new norm.

The cost of care has increased significantly. Researchers at the Alzheimer's Association (2015) estimated that the cost of caring for people with Alzheimer's disease and other dementias was $226 billion in 2015. Medicare and Medicaid covered approximately $153 billion, which is 68% of health care and long-term care payments for the elderly (Alzheimer's Association, 2015). These costs are significantly lower than the costs of U.S. expenditure on overseas conflicts, and police actions in 2014. They amounted to $4.4 trillion (Carasik, 2015).

Regardless of financial assistance, people with Alzheimer's disease and other dementias pay high out-of-pocket costs for deductibles and copayments, not covered by Medicare. They must pay on average $19,642 annually in out of pocket expenses to live in assisted living facilities (Alzheimer's Association, 2015). Compared to people with other conditions, they are three times more likely to have hospital stays for conditions like syncope, fall and trauma, ischemic heart disease, and gastrointestinal disease (Alzheimer's Association, 2015, p. 47). By improved access to AT, and preventative and geriatric care hospitalizations can be avoided

Unfortunately, only a small number of people with Alzheimer's and other dementias can afford to pay for long-term care. Many patients with low income rely on Medicare and Medicaid for coverage (Alzheimer's Association, 2015). Most beneficiaries who qualify for Medicaid must use their Social Security income, and any other income, except for a small allowance, to pay for long-term care (Alzheimer's,

2015). Analysis conducted by the Alzheimer's Association revealed that the annual payments for health care, long-term care, and hospice care, for the cognitively impaired elderly were projected to increase from $226 billion in 2015 to more than $1 trillion in 2050. The increase is attributed to Medicare and Medicaid costs, and in out-of- pocket expenditures (Alzheimer's Association, 2015).

Only two programs can prevent long-term, or nursing home stays. The first centers on caregivers, and the second focuses on the care delivery team (Alzheimer's Association, 2015, p. 55). More research is needed to determine the programs' applicability to a wider population with Alzheimer's disease, and their caregivers (Alzheimer's Association, 2015, p. 55). Regrettably, AT that could help reduce these high costs were not taken into consideration. Scientists believe that all those involved in the care providing activities would benefit from AT. Assistive technologies elevate efficiency and reduce the need for human labor.

Technology and Innovation

History and Tradition of Assistive Technology

The use of AT and assistive devices has garnered decades of attention from many researchers. The National Institutes of Health (NIH) was established in 1887 to provide resources for research and medical care (NIH, 2016). Assistive technology such as mobility aids represents types of AT (NIH, 2012). The kind of ATs used, and their frequency of use are determined on an individual basis with patient input, and with the disabled person's family members, and caregivers (NIH, 2012). As noted, AT is used to compensate for an individual's impairment or as a rehabilitation resource.

Tools are being reshaped and technology reorganized for individuals with disabilities. The Center for Disease Control and Prevention (CDC, 2012) reported that an estimated 53 million people, one in five Americans, has a disability. Thirty-three million Americans have a disability, making it difficult for them to carry out their daily activities (CDC, 2012). Americans with disabilities as well as the elderly rely on AT in their day-to-day lives to complete their daily tasks and for mobility. Assistive devices are used for individuals within broad major categories: (a) cognitively disabled, (b) hearing disabled, (c) physically handicapped, (d) vision disabled, and (e) the mentally ill (CDC, 2012).

Barriers to the Use of Assistive Technology

According to a survey conducted in 2008, 7% of physicians used email to communicate with their patients (Topol, 2012, p. 188). The lack of compensation is one reason for low email usage among fee-for-service doctors. It was notably higher among salaried physicians (Topol, 2012). Another major reason was the federal privacy rules and communications, through secure websites, exclude Gmail or Outlook. Unauthorized disclosure of health information is a violation of HIPAA and can result in a $250,000 fine or imprisonment (Topol, 2012, p. 189). Additionally, the American Medical Association (AMA) policy states that email can only be used to supplement personal encounters, and not to establish patient relationships (Topol, 2012, p. 189). Thus, physicians saw email use as a liability because of the potential for malpractice litigation. For this reason, the usage of electronic communications between doctors and patients has remained limited (Vydra, Cuaresma, Kretovics, & Bose-Brill, 2015).

The Gmail or Outlook standard of communication may not be suitable for doctor-patient interactions. However, the iPhone with FaceTime makes such bidirectional video links possible (Topol, 2012, p. 192). The eye contact allows the doctor to see the patient's facial expressions such as bewilderment or comprehension. Additional services, such as Skype and other comparable computer-to-computer video-conferencing provide productivity and efficiency to both doctors and patients. Few medical groups have attempted to utilize both email and video conferencing. The participants have been happy with the services they received. Studies are still needed to determine whether video communication decreases the number of emergency room visits or inpatient stays (Topol, 2012).

The ZocDoc appointment-scheduling program has been markedly popular with physicians who pay $250 per month to fill their open appointment lists (Topol, 2012). This app is easier to use, compared to the existing models of doctors' electronic appointment systems. The hope is that the usage of electronic communications continues to increase significantly in the future. Many substantial barriers need to be confronted. The paternalistic period is over. It is time for consumers to take charge of their well-being.

Some individuals and health care providers resist the use of technology. O'Neill and Gillespie (2014) asserted that there is little evidence that people with cognitive impairments will accept AT. The five contributing barriers include defective equipment, the cost of replacement, executive functioning impairments, physical hurdles, and ethical apprehensions. Some people with dementia believe that technology is not safe and may

impede natural recovery (O'Neill & Gillespie, 2014, p. 90). Of the five barriers, executive functioning impairments, is the most difficult to overcome. Some individuals express concern, regarding the possibility of a compromised privacy as well as a fear of isolation from others (O'Neill & Gillespie, 2014). People with cognitive impairments require an implementation of several mental tasks such as planning, focusing attention, and remembering instructions, for the technology to be applied successfully.

Current State of Assistive Technology and the Need for Innovation

The health care challenges in the United States are numerous. Per capita, health care spending in 2012 increased by 18% while the workforce in 2014, including those trained in geriatric mental health, declined (Bartels, Pepin, & Gill, 2014; Bottles, 2012). In 2014, the United States had 1,800 geriatric psychiatrists (Bartels et al., 2014, p. 7). By 2030, the number is estimated to drop to 1,650. There will be one geriatric mental health professional for every 6,000 older adults. These shortfalls will extend to other geriatric mental health practitioners as well (Bartels et al., 2014, p. 7). The hope is for this trend to change, but if it does not, the new technology may help solve the deficit of trained mental health providers.

Additional research exploring the use of AT is necessary. Research has focused on designs, and on innovative technologies, to assist people in their cognitive and physical functions (U.S. Department of Health and Human Services, 2011). Many technological innovations and discoveries propel us to move forward. Technology is a driving force in our society.

New ideas are not always embraced. We often choose the ones that were tested. The repeated testing of products make us feel safe. The bigger the new ideas, the more difficult it is for us to examine their practicality and usefulness (Berkun, 2010). For example, pharmaceutical solutions for disorders are real, but the greater the changes, the more apprehensions rise. Unlike the pharmaceutical solutions, AT gains prominence without the prolonged and often unnecessary testing. The benefits for millions of people with dementia include independence. As well as a delay in institutionalization.

Innovation

The total number of elderly with mild dementia will rise to 115.4 million persons by 2050 even as medical progress and diagnostic technology improves (Inoue et al., 2012). The older populations in developed countries will employ the newest technology to help with daily activities. That is less likely to occur in developing countries. Thus, tools such as computer programs, and robotics, will not solve all the problems worldwide, but may reduce diagnostic errors, monitor safety and security, and ease mundane routines provided by caregivers.

Assistive technology should be inexpensive as it considers specific individual cognitive impairments such as mild or severe disability. Scherer, Hart, Kirsch, and Schulthesis (2011) demonstrated that technological designs, restricted to specific target behavior, have better mood and motivation outcomes.

Scholars have also found the abilities of the cognitively impaired elderly to be of extreme importance. Boger and Mihailidis (2011) argued that AT used by individuals with cognitive impairments should accommodate their skills. The authors pointed out that

the sick exhibit distinct strengths and weaknesses. Scherer et al. (2011) argued that a prospective memory aid that self- prompts and solves problems is helpful to many cognitively impaired elderly individuals.

Service robots, such as the "robotic cane," have been designed to monitor vital signs. They help with mobility and provide physical support for walking. A robot that accompanies seniors in independent, or assisted living facilities, can remind them about their scheduled activities, and offers them other information such as weather forecasts (Fasola, 2014). The prudent use of technology reduces personnel and lowers administrative costs, while contributing to longevity.

The evolution of life has progressed through the past several centuries. In the 20th century, life expectancy in most developed countries rose steadily (Zhavoronkov, 2015). In his 2015 analysis, Zhavoronkov showed that longevity outlooks were grounded in family history and statistical calculations. Freeman, Garcia, and Marston (2013) pointed out four predictors of survival: (a) lifestyle choices, (b) community and environment, (c) attitude toward life, and (d) goal setting and attainment (p. 721). The gains have also been associated with a decrease in child mortality, improved antibiotics, and the discovery of new medicines and in improved technology.

The cellphone has changed many people's attitudes, and behavior, in its ability to collect information about our health. In the last decade, cellphones have provided us with extensive measurable data (Torous, Staples, & Onnela, 2015). They contribute to a wide range of diagnoses. Scientists can track a patient's mood with cellphone data by trailing the frequency of outgoing and incoming calls or unchecked email messages. The global

positioning system (GPS) sensor shows both slow and jerky movements during sleep. The data can be sent to a patient's doctor, to aid his diagnosis of a mood disorder or dementia. Mental health providers rely on what patients say to determine their state of mind. Patients sometimes misinterpret their state of mind. Consequently, measured objective observations, such as the distance someone has traveled, or measuring voice intonation, can produce a picture of one's health and emotions (Torous et al., 2015).

Smartphones provide more information directly to the consumer than ever thought possible. Some iPhone apps measure blood chemistries, hemoglobin, and oxygen concentrations in the blood. Other technologies quantify mood through digitizing the voice, galvanic skin response, motion, positioning, and communication (Torous et al., 2015). Digitized breathing can predict asthma attacks as well as lung cancer. Digitized tears, measure glucose, and help with other body chemistries. The Oscan can detect oral cancer. Some watches can predict seizures (Topol, 2012, p. 250). The smartphone, used by everyone, contributes to a healthier and better life.

These innovations create controversy among scientists, and among everyday users of wearable devises. For example, Patel, Asch, and Volpp (2015) were not optimistic about the technology. They believed there is a gap between wearable health tracking devices, and the actual behavior change. Behavioral change, they think, requires motivation, encouragement and collaboration, technical monitoring, equipment, and maintenance. Furthermore, wearable devices do not always have the same memory capacity or life expectancy as stationary home-based technologies (Patel et al., 2015). Patel et al. (2015) argued that those who least needed wearable devices wore them the

most frequently. The less prosperous elderly, who could benefit the most, were often deprived (Patel et al., 2015). The lower usage resulted most from inadequate training, and the high cost.

Technology does not have to be wearable or expensive. The Google Calendar is a free memory aid, accessible on the Internet (O'Neill & Gillespie, 2014). Its best feature is a scheduled text prompt that can be sent to a cellphone. The calendar is easy to use, and compared to a regular journal, it is more helpful (O'Neill & Gillespie, 2014). Similarly, Television Assisted Prompting (TAP) programmed from a computer turns on a TV to deliver cues. The TAP system increases the completion rates of scheduled tasks, and thereby increases confidence (O'Neill & Gillespie, 2014). These inexpensive items work independently or in conjunction with wearable devices.

New low-cost applications that check distance walked, calories burned, and heart rate are turning up daily. The wearable health tracking devices frequently referred to as a "quantified self," have changed the status quo of health care (Patel et al., 2015, p. 1). Elderly patients can now track their health outside of the doctor's office. These low-power noninvasive health-monitoring devices can be integrated into electronic medical records (EMR) via the Internet. In 2006, Milenković, Otto, and Jovanov, warned that using the Internet for this purpose could violate HIPAA's information protection act. A decade later, infringement of privacy, and cybercrime, accelerated but so did security applications, protecting personal information and homes.

For many elderly, their homes have become bastions of safety and comfort. The "smart home" that can incorporate several assistive technologies, such as sensors that

monitor lights, kitchen equipment, and electronic equipment, has become the new expensive platform for independent living (O'Neill & Gillespie, 2014, p. 38). Wearable cameras called SenseCams, developed by Microsoft, compensate for autobiographical memory by recording selective daily activities. The images contain behavioral cues for the elderly that can be reviewed at any time (O'Neill & Gillespie, 2014, p. 39). SenseCams can also be used as a therapeutic tool to increase long-term memory of events and awareness.

Several of the present more expensive technologies have also been used in communities and acute care settings. These technologies include products that will enable seniors to perform daily life activities more efficiently (Tak et al., 2010). A person-centered home setting should be created wherein seniors become the key users of products such as "biosensors, activity sensors, information fusion systems, ambient displays, as well as remote community and collaboration" (Tak et al., 2010, p. 3). Improving the quality of life adds to the comfort, and to the longevity of seniors. It also improves the lives of the caregivers. Fasola (2014) pointed to the benefits of socially assistive robots (SAR) that help to fulfill the social and emotional needs of the elderly (Fasola, 2014). The study found that robots attended by human handlers improve the attitudes and memory of the participating seniors in just a few weeks. Another analysis found that robotics promoted social contact. Older people who worked with robots interacted better with each other (Fasola, 2014). The development of AT and the continued development/evaluation of AT made seniors curious and happy.

While robots and software programs are influencing seniors' lives, simple incentives to remember also play an essential part. Langer (as cited in Lapham, 2014) found that indifference in elderly patients in a nursing home was often mistaken for memory loss. Their daily living responsibilities, however, triggered corrective and healing measures. Lapham (2014) also reported in a study of 3,000 participants lasting 10 years that participants, who were taught speed-of-processing computer games, improved their driving. They experienced fewer accidents. The elderly, instead of leaving medicines on a kitchen countertop and using Post-It notes as reminders, can now use more modern Glow-Caps to track their opening of medication using LEDs technology. The bottle caps light up, reminding the user to take his medicine. When unopened, they also send a message to that effect (Lapham, 2014). The conflict between rapidly growing technology and slow-changing human behavior continues. But, the AT frontier is expanding to enrich the lives of many, especially the cognitively impaired elderly.

Problems related to dementia range from memory failure to shortened attention span and causing difficulties in daily activities. Even though calendars, memo pads, and clocks, can be helpful, people with more severe dementia cannot use them. As a result, daily activities are not completed. Advanced AT, however, is helpful (Inoue et al., 2012). The prototype of a communication robot named "PaPeRo," produced by NEC Corporation, was designed to interact with people with dementia (Inoue et al., 2012, p. 270). The robot is outfitted "with speech recognition, speech synthesis, facial image recognition, autonomous mobility, head motion, light indication functions, and tactile sensors" (Inoue et al., 2012, p. 264). PaPeRo reminds persons with dementia of their

daily schedules and successfully prompts them to act. Inoue et al. (2012) showed that participants approved of the robot 90% of the time. This suggests acceptance of the robots in independent living facilities (p. 268). The approval rates by the participants were high. Only a few had trouble understanding and using the robot. General remarks describing the robot ranged from good to excellent (Inoue et al., 2012). Still, what technology will become widely accepted is not yet known, but the hope is for inexpensive and practical devices that can help maintain the activities of daily living.

Research and Development

One of the most daring projects in the past quarter of the century is the Blue Brain Project, founded in May 2005 by Markram of the Brain and Mind Institute of the Ecole Polytechnique Federale de Lausanne (EPFL) in Switzerland[1] (Honigsbaum, 2015). It was created to facilitate progress in brain disease treatment (Artificial Brain, 2012; Honigsbaum, 2015). The aim of the projects within the next ten years is to build a functional model of the human brain and replicate it on a supercomputer (Honigsbaum, 2015). This ambitious undertaking has had many financial and operational difficulties over the years, but technological advances have still moved the project forward.

With the advent of MRI science, investigators learned a lot about brain regions, organization, and neuron interconnectivity. However, scientists still need to learn more about genes (Honigsbaum, 2015). The brain contains about 100 billion neurons with 1,000 trillion synaptic connections and interactions between them, making experimentation difficult (Honigsbaum, 2015). According to Markram, the

[1] https://sv.epfl.ch/BMI

supercomputer could be used to calculate thousands of statistical models to predict neuron behavior in dementia and also compare it with other real biological data (Honigsbaum, 2015).

Experimentally mapping out the human brain in a single neuroscience laboratory is problematic but working in teams can produce positive results (Honigsbaum, 2015). Markram's intent is to correlate all diseases and put them in clusters mathematically. Once this is accomplished, a new biologically grouped classification system with new diagnostic tools and drug development will be possible (Honigsbaum, 2015).

The BRAIN initiative in the United States took a different approach. It is not autocratic but consists of many diverse groups of contributing scientists. Its aim is to create better tools to calculate activity in the brain (Requarth, 2015). Similarly, in the Human Genome Project, scientists need to interpret "three billion base pairs" sequence cautiously (Requarth, 2015). Thus, the better we can examine the brain, the better we can understand cognitive impairments. Science is still in the dark about how memory works, but scientific initiatives can bring us closer to cures to finding out.

The Watson project has changed the way in which we make decisions and approach medicine. Ferrucci (2010) and his IBM team successfully designed a computer system that integrates language processing and semantic technology (Bottles, 2012). The team had immeasurably advanced computer-supported intelligence and moved toward improved diagnosis.

The RAMCIP (Robotic Assistant for MCI Patients at home) project funded by the European Commission under the auspices of HORIZON2020 started in January of 2015

(European Commission, 2015). It differs from other projects because its technologists are attempting to design a dexterous, assistive robot with manipulative competencies that help older people with MCI live better lives (European Commission, 2015). Its mission is to assist in all aspects of daily household activities, such as eating, dressing, and regular exercise while highlighting empathic communication and safety (European Commission, 2015). The marked difference between this robot and others is its ability to improve the user's decisions on how to and when to assist with empathy (European Commission, 2015). The obstacles that beset this technology are affection, understanding, and kindness.

Summary

The changing face of health care is apparent in general practice, mental health, and geriatrics. Assistive technologies are helpful in the planning and execution of daily activities, and as reminders of missed doses of medication. The literature search brought many reviews from the scholarly literature on the emergence of AT for the cognitively impaired elderly. The study's foundation is based on poststructuralism, mainly deconstruction, as a way of analyzing literature, and hermeneutics, as a reference to verbal and nonverbal communication. The increase in longevity is playing a significant role in altering communication between the young and the old. The hope is that despite economic and low birth obstacles, different age groups will continue to support the growth of AT. None of it will be possible without changes in health policies, access to full coverage, and policies that protect the health information privacy of everyone. HIPAA's responsibilities for adopting stringent rules of viewing PHR and EMR is of

importance for the cognitively impaired elderly. Mental health impairments, specifically, neurocognitive disorders, can range in levels of severity from mild NCDs to severe NCD or dementia.

Unfortunately, treatments for Alzheimer's disease don't stop the neuron damage that makes it a fatal disease. Moreover, the number of health professionals, such as physicians, physician assistants, registered nurses, social workers, and caseworkers who specialize in elder care, has declined while costs have increased. Additional research exploring the use of AT to improve the quality of life is needed. The ongoing research focus is on designs and innovative technologies and techniques that will assist people with their cognitive or physical failings. Some individuals resist the use of technology because of its cost, physical impediments, or ethical concerns. Nonetheless, by 2050, the number of elderly with mild dementia will rise significantly even as medical progress and diagnostic technology improve. Assistive technological interventions should be inexpensive and should be developed to address specific individual impairments. Much remains to be learned about how memory works, and scientists continue to seek cures for Alzheimer's and other dementia.

In Chapter 3, I discuss the methodology, the research design and approach, setting and sample, instruments and materials, data collection procedures, data analysis, methodological limitations, and the ethical safeguards to my research.

Chapter 3: Research Method

Introduction

In the preceding chapters, I discussed technological advancements that assist the cognitively impaired elderly. These technologies, ranging from the simple fall-alarm buttons to the sophisticated robotics, are being developed in response to the growing need for the aging U.S. population. By the year 2050 there will be an estimated 13.8 million elderly people with dementia, and about $1 trillion will be spent on their health care alone (Alzheimer's Association, 2016). While innovations are being developed daily, the number of caregivers is declining. Hence, there is a need to develop technology that can assist the elderly with their daily activities. Gladman et al. (2012) pointed out that the adoption of technological innovations may delay the need for long-term institutional care and promote independence for the elderly.

The theoretical foundation for this investigation was grounded in poststructuralism and hermeneutics. Inayatullah's (2008) six pillars approach was used because it proposes that research should map the future, anticipate the future, time the future, deepen the future, create alternatives, and transform the future (Inayatullah, 2003, 2008). Causal layered analysis (CLA) was the overall analytical framework that informed this research. It explored four layers of futures analysis and served as one source of data and the questioner for additional data. Futures triangle analysis (FTA) was used to inform the second CLA level–social change dynamics to assess *the pushes, pulls, and weights*, or the trends and resistances to change.

To embark on this study, I assumed that larger numbers of the elderly are living alone and are willing to use AT. Caregivers will benefit indirectly from these technologies. I assumed too that technological innovations will produce devices that are smaller and cheaper over time. A limitation to this study was that I did not consider age constraints, ethnicity, or gender distinctions.

This chapter introduced the rationale for the research design. It also explained the role of the study and delivered a justification of methodology. Finally, it described participant selection, instrumentation, data collection, and data analysis. Plans to foster trustworthiness and ethical behaviors were also defined.

Research Design and Rationale

The research questions were based on the FTA and comprised three dimensions: the pushes of trends in the present, the pulls of our images of the future, and the weight of history (Inayatullah, 2008). The CLA construct explores phenomena by analyzing four layers of reality: the litany, social causes, discourse/worldview, and the myth/metaphor, of the topic under analysis (Inayatullah, 2008). In that regard, CLA was appropriate because it reflected the post-structural deconstruction and hermeneutic interpretation, which allowed for a query into the complexities of the past, present, and future. Inayatullah's (2008) CLA delivered a full account of actual issues, and the objects being examined, rather than the familiar predictive orientations, which merely "skim the surface" (i.e., the litany level). CLA offered the analytical framework that examined texts and articles as well as a focus group and surveys.

The poststructuralist viewpoints of Derrida and Husserl (as cited in Bensmaïa, 2005) and the other continental philosophers maintain that there is an inherent unpredictability in the human sciences. Instead, the reader of a study is said to derive their own rationale and meaning from a given text. Poststructuralism presented the theoretical framework and a basic vocabulary to understand the structure and information of developing technology (Tredinnick, 2015). As a result, the following central research question and sub questions were developed:

Central Research Question

What are the alternative futures of assistive technologies for the cognitively impaired elderly, 65 years old and older, by 2037?

Subquestions

1. What are the implications for major trends in health care services, demographics, and in other major driving forces of change in AT?
2. What are the forces of resistance, myths and metaphors, and narratives surrounding AT?
3. What are the probable, possible, and preferred futures of stakeholders in AT?

A range of methodologies were considered. I rejected a case study as it did not align well with the analytical tools. An ethnographic study was also considered but was rejected because of its focus on a group's behavioral activities and patterns (Creswell, 2007). Finally, I chose a focus group as a data source for analysis, and questionnaires selected as a congruent and parallel source of data on projected trends in AT and in the industry.

Role of the Researcher

I was the primary instrument for data collection in this study, an approach supported by many qualitative scholars, including Patton (2002), Creswell (2013), Corbin (2008), and Strauss (1990). Qualitative data were generated by a focus group and two questionnaires. The focus group participants were seniors from a senior center in New York. The first questionnaire was sent to expert participants. The second to University's pool participants' family members of the cognitive impaired elderly. The focus groups protocol is included in Appendix A and questions in Appendix B. Additionally, memos and field notes, documenting my thoughts and observations were digitally recorded. Other related issues, such as my potential bias and problems that could influence the ethics and credibility of this study were communicated later in the chapter.

Personal and Professional Relationships

The participants included individuals from three distinct groups. The first group were seniors from a senior center in New York. The second group was an expert sample from members of an Engineering Society, who are experts in the fields of rehabilitation and AT. The third group was a University's participant pool. I had no professional or personal affiliation with the senior center or the University's participant pool, but I am a nominal Engineering Society member.

Researcher Bias

The CLA reflects a poststructuralist philosophy, which questions limits. As a result, bias can occur at any stage of research. According to Patton (2002), a study must be trustworthy and authentic to reduce bias. The neutral investigator must understand the

behaviors, and the opinions of those participating in the focus group (Patton, 2002). For that reason, qualitative research has been considered subjective. But absolute objectivity is impossible to attain. Thus, I understand that bias exists, but in this study, every effort has been taken through bracketing, to ensure impartiality, trustworthiness, and authenticity by keeping detailed notes and audio recordings (Patton, 2002). The audio recordings of the focus groups can identify divergent, preconceived notions. Bias was minimalized by my asking open-ended questions; I evaluated every response equally while maintaining a neutral stance.

The research included focus groups related to AT for the cognitively impaired elderly conducted with the senior citizens at a senior center and experts from Engineering Society and the University participant pool, who were surveyed anonymously. Thus, triangulation was a part of the mechanism to reduce bias.

Subsequently, the participants reviewed their responses and provide feedback (Patton, 2002). The primary stance included hermeneutics, which denotes strict interpretive rules without distortions in the texts to ensure objectivity. Additionally, reflexivity played an important part in the bias reduction because it allowed for the researcher reflection of oneself and the study relationship. It is a voice that reconfirms trustworthiness and authenticity (Patton, 2002).

Both self-awareness and self-analysis played an important role in who participated in the study and what topic were chosen. I thought of the social responsibility of a researcher who presents findings to other investigators so that they can review, understand, and use them in later studies (Patton, 2002).

Other Ethical Issues

All participants in the focus group were chosen because they are seniors from a senior center in New York. The participants were aware that they were expected to explore a wide range of topics that pertained to the research questions. Group discussions took place for 90 minutes. I asked open-ended questions, a recorder captured participants' voices. A note taker took brief notes and observed the participants' body language and behavior for debriefing. Research participants were free to generate their own questions and to explore new and unexpected threads or discussion themes.

Group work in a focus group includes different forms of interaction, including anecdotes and jokes, which are not possible using more conventional data collection techniques. However, the weakness of such focus groups is that an "articulation of group norms may silence dissenting individuals" (Kitzinger, 1995, p. 300). The participants were able to actively discuss even taboo topics because the less reserved participants "broke the ice" for the shy ones. One strategy was used: a short exercise designed to "suspend disbelief," to free the participants to be more creative and open-minded about the futures, allowing them to share in group feelings (Kitzinger, 1995). One strength of the CLA approach is the use of structured segments to generate data for each level. For example, the focus groups may employee a futures wheel (see Figure 3) to help empower and challenge participants to explore various outcomes that may help inform policy answers to the cognitive problems, and independent challenges of the elderly with dementia. The second group comprised of members of the Engineering Society, experts in the fields of rehabilitation and AT who answered a 10 questions questionnaire/survey.

Methodology

Thematic content analysis acknowledged as one of the inductive methods used to analyze the qualitative data was applied in this study. Here themes were derived from the data, which prevented the researcher from imposing his views. This process involved transcribing the focus group, and the questionnaires/surveys, and going through the transcripts line by line to identify meanings, and emerging themes (see Table 1).

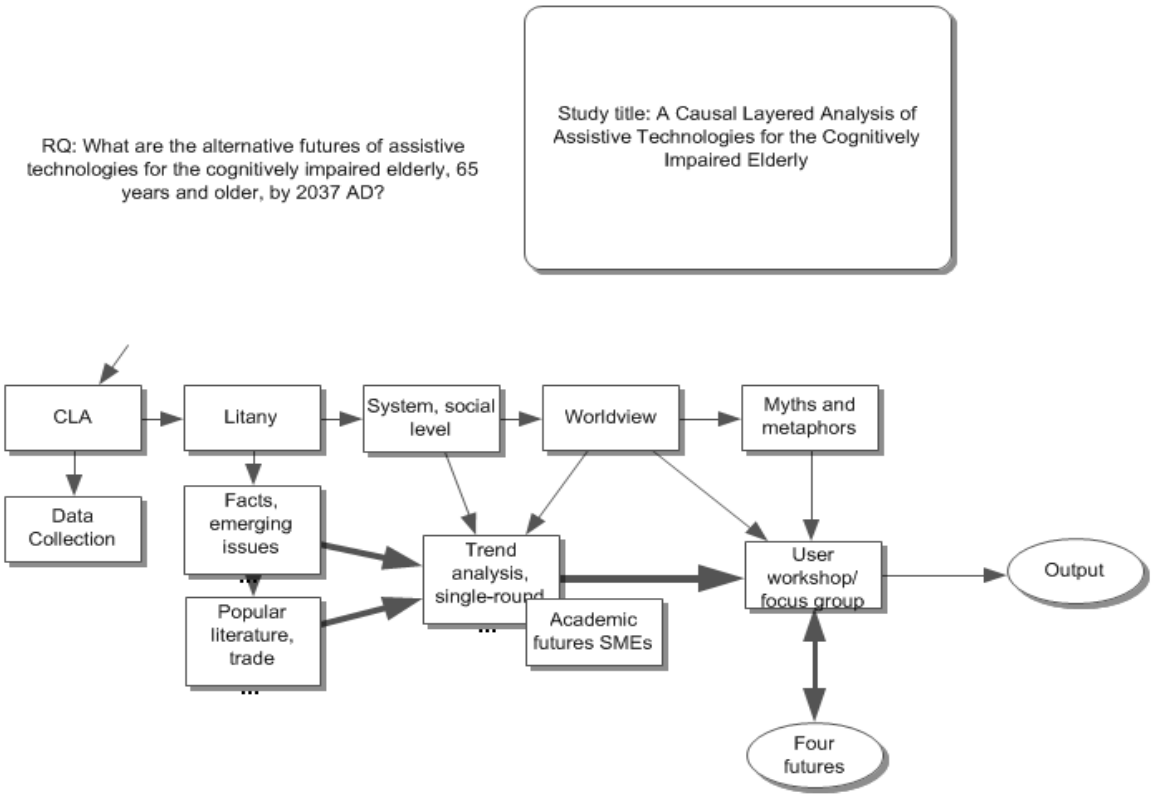
Table 1

Coding Example

Senior Code[a] Futures of Assistive Questioner/ Focus Technology	Expert Code[b]	Data Collection[c]
Trends	Demographics	all
Driving forces	Stakeholders	1, 4, 6
Implications	Generational	all
Resistance	Policy	2, 3
Myths and metaphors	Narrative	5, 7
Probable, possible, and preferred	Futures	all

Note. [a]Alternative group question. [b]Further break down to code. [c]Questionnaire.

Figure 3. Causal layered analysis flowchart.



The themes were coded based on meaning. Similar meanings were designated under the same code (Saldaña, 2013). The flowchart (see Figure 3) shows the methodological steps taken in designing this study.

Participants

Purposeful sampling was chosen for this study because it requires a diverse population and efficient resources. Also, identifying and selecting individuals that are particularly well-informed about the subject of the study was essential. Purposeful sampling offered valuable indicators of the experiences analyzed. It examined information-rich projects and provided in-depth comprehension rather than experimental simplifications (Palinkas et al., 2015; Patton, 2002).

Thus, invited participants were informed about the purpose of the focus group and its benefits to both participants and organizers (Lauttamaki, 2014). In futures studies, which may utilize a futures wheel method of collecting data, a group of eight to 12 people is sufficient (Lauttamaki, 2014). Similarly, in the questionnaire, the number of participating experts was anticipated to be small (Gordon, 2009). Saturation occurs within the first 12 interviews or questionnaires, and the basic elements for metathemes are present as early as six interviews and questionnaires. Variability within the data followed similar patterns (Guest, Arwen Bunce, & Johnson, 2006).

The focus group was expected to range between eight to 12 people. The engineering society members estimated the return of the questioner to be 10 to 15 experts. However, it is not always feasible to predict a specific number of participants because it varies with the nature of the study. The engineering society members who replied became sources of data for analysis in the study.

An announcement in the institution's daily/monthly/weekly activity announcements was posted and printed asking potential participants to register and communicate their willingness to part take in the upcoming focus group study. Assistive technology experts were notified via the Cognition and Sensory Loss Listserv. The Listserv is hosted by L-SOFT and limited to engineering society's membership. Each member selects the listserv that best represents their professional interests. Of the 14 listservs, the Cognition and Sensory Loss listserv is one of the most popular and populated by 178 members.

Data collection was the purpose of the focus group and two questionnaires. I selected participants of the focus groups by employing purposeful sampling. In the questionnaires, I used expert sampling, a type of purposeful sampling, needed to select individuals with expertise. My intent was to generate data that relates to the futures of AT for the cognitively impaired elderly.

The focus group comprised seniors who were not yet institutionalized and who were still independent and who could report on the topic of the futures of AT for the cognitively impaired elderly. The second group was engineering society experts in the field of AT. Hence, I found a diverse group of participants as well as professionals who had broad experiences in the disciplines related to AT for the cognitively impaired elderly. The quality of the outcomes depended on the input of the partakers of the focus group, participant pool, and the expertise of the engineers. Access was gained by asking headquarters of the senior center for a permission to conduct a focus group study. When permission was granted participation for all three data collections were announced on their websites, and in newsletters.

Instrumentation

The focus group interviews were recorded. Participants were asked to follow a verbal protocol in which they agreed to respect each other's opinion and give each other an equal chance to speak. Written forms included a focus group protocol (see Appendix A), focus group questions (see Appendix B), questionnaire/survey (see Appendix C), project summary (see Appendix D). All the documents were presented to and signed by the participants before the scheduled focus group meeting.

At the beginning of the focus group, I assigned each participant a number, followed by my restatement of the focus group's purpose. I reminded members of the group that brainstorming is welcome because all opinions can be inspiring. The group comprised a small number of participants. Everyone had enough time to speak and to feel involved. Thus, the topics were discussed in depth. All participants were thanked for their participation, and I frequently used statements such as, "Can you talk about that more?" or "Alternatively, you might consider..."

Slaughter (1996) claimed that future tools are useful when individuals can understand issues from a few analytical levels. For example, a futures wheel, (Figure 3), is a simple tool in which the development/event/or issue is positioned in the center of a piece of paper with its outcomes marked in a circle. The implications are then explored in an outer circle, and new circles are then added to explore the tertiary implications or consequences (Slaughter, 1996). Thus, an ideal starting point for many topics is created. This tool can be used as a mind map, a method of discovering data, and for a deeper understanding of the problem (Slaughter, 1996). The futures wheel will be discussed in greater detail later in the chapter. According to Slaughter, futures tools are not isolated. Future groups are flexible and can be amassed in diversified and productive sequences (p. 8). In that respect, Inayatullah (2008) supported Slaughter and believed that CLA is a successful research method that allows for the, "inquiry into the nature of the past, present, and the future" (Inayatullah, 2008, p. 2). The tools Inayatullah notes permit futures research to be scientifically conducted, as I am have done in my research.

I prompted all participants to engage in a conversation. The meeting was audio recorded. The recorder captured as much essential information as possible on flip charts. The note-taker recorded and observed body language. I led the focus group through the various levels of the CLA process. The recorder captured and posted the discussion on the wall during the focus group. After the session, the recording was transcribed. The transcript was triangulated with the note taker's records and my tear sheets.

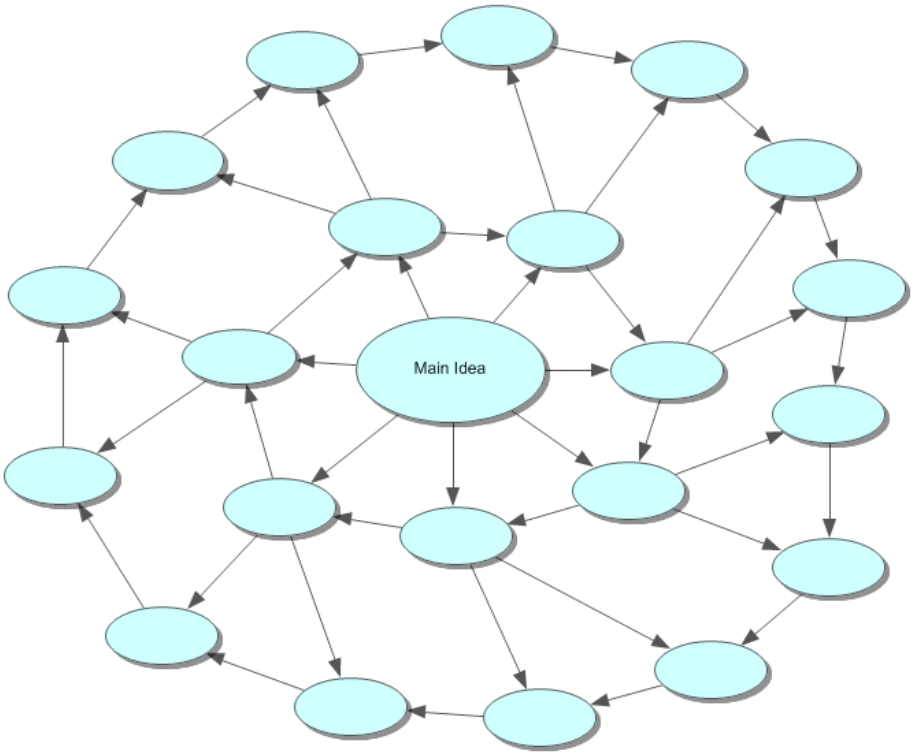


Figure 4. Futures wheel.

The survey method of collecting data has been successfully employed in the futures studies with questions about artificial intelligence, policies, designs, and resource allocations. The main reason for its success is its ability to tap into participants' knowledge of the subject being studied. Engineering society has a body of experts on

cognitive impairments. The data collection method was employed by using the engineering society listserv and university's participant pool. Thus, the asynchronous participation of experts in the field of AT and the family members of the cognitively impaired were identified and asked to participate in the survey/questionnaire (Gordon & Pease, 2006).

Data Collection Instruments

Glenn (2009) first used the futures wheel as a data collection instrument in 1971 when he was a student at the Antioch Graduate School of Education. Since its development, it has been used throughout the world by trainers, consultants, corporate planners, and policy advisors as a technique to assess focus group participants' future concerns. A futures wheel can assist in identifying the primary, secondary, and tertiary outcomes. It can also help organize known information that helps individuals understand new events (Glenn, 2009). A futures wheel also suggests underlying forces of change and noteworthy trends. Its goal is to build a structure around unsystematic thinking and assumptions. It permits the mind to move forward from one wave to the next but also allows for successive analysis. The futures wheel is a powerful, simple tool used to explore primary secondary and tertiary social impacts, and to also provide a mechanism to identify challenges and prospects while assessing alternative approaches. The futures wheel does not require special preparation, other than sheets of paper, pens, and Post-it notes.

The questionnaire method is quick and inexpensive. It minimizes ambiguous components in face-to-face encounters. Today's technology easily connects experts,

allowing them to answer promptly, reducing the questioner's response time. Experts cannot predict the future, but their expertise can be analyzed, to result in a clear and reliable picture of the future of AT. For these reasons, CLA integrates futures wheels, and the questionnaire, into its method which provides a deeper input into the future analysis.

Data Collection Procedure

The futures focus groups included ten people each from varied backgrounds who shared similar curiosities and concerns (Lauttamaki, 2014). The focus group was used to assess options about existing products and behaviors and to seek new possibilities for an independent and better life for the cognitively impaired elderly.

The focus group participants discussed a time span of 20 years into the future (Lauttamaki, 2014). The venue was a quiet place that allowed participants to work undisturbed. The duration was approximately 90 minutes; time extensions were not permitted (Lauttamaki, 2014). Verbal clarifications of issues were offered at the end of the workshop.

Before the focus groups meeting, I circulated a project summary (Appendix D) with key issues and trends. The futures focus groups consisted of four phases:

1. The preparation phase: A large conference room with a smart board, papers, pens, and papers were prepared.
2. Critique phase: The problems were investigated critically and thoroughly.
3. Fantasy phase: Possible futures were envisioned.
4. Implementation phase: Ideas as well as solutions were evaluated, and an action plan was written down (Lauttamaki, 2014, p. 5).

Phase 1 did not require special equipment. Upon the participants' arrival, I presented an overview of the issues and objectives. Because background information was provided in advance, everyone was able to participate in the focus group discussion. The participants were seated at a table to facilitate collaboration and access. All participants were encouraged to keep an open mind about their views. My assistant/note taker and I monitored the functioning of the participating group. Participants shared their life experiences and spoke about their ideas for the future. The critique phase unmasked and display a current understanding of the topics (Apel, 2004). The fantasy phase was the creative phase wherein visions of different futures were reviewed. In the fourth, implementation phase, "central actors and actions" stages came alive and surface (Lauttamaki, 2014).

The futures wheels were implemented in the creation of four scenarios. Special equipment was not required, other than sheets of paper, pens, and Post-it notes. The creation of futures wheels proceeded as follows: After five minutes of thinking and note taking on the central issues, they were written down in the middle of the paper. Next, I drew a circle around the main topic. Outgoing short spokes were then added to the circle; new information was written and circled. Thus, the first impact, and a primary ring was created. Next, new ideas from the main circle were considered. As the ideas were presented, two spokes were drawn from each of the primary circles, creating a secondary ring with new circles. The process was repeated. When it was decided that all ideas are denoted on the wheel, they were evaluated and revised. Items that belong thematically together were grouped (Glenn, 2009; Lauttamaki, 2014).

Extra data were collected through online surveys. Carrying out studies of vast complexity in a relatively short period became feasible because the Internet offers the option to invite experts to participate in the open-ended questionnaire. SurveyMonkey was used to gather data from participants of this study. Users' security and privacy is a staple of SurveyMonkey evidenced by the websites use of SSL/TLS encryption, user authentication, and user unique login and passwords. An additional advantage of the web-based questionnaire approach is that contributors can login and out as often as they wish during the provided study period. The participants' responses are saved and recalled when needed. There are no specific single rounds to respond to the questions. Notably, there were challenges with coding and with analyzing data, acquired through the questionnaire with open questions (Gordon & Pease, 2006). Nevertheless, conducting research with an open-ended questionnaire produced unexpected, unique, and valuable research findings.

Data Analysis Plan

The following data collection measures were used in this study. I analyzed the information collected at the focus group meeting and the questionnaires data collections. In this exploratory thematic content analysis, I maintained a systematic analysis that closely associated with the research questions as well as with the analysis' objectives (Guest, MacQueen, & Namey, 2012). There were four steps in this process:

1. I reviewed the data with a complete understanding of the subject.
2. Next, I organized the data for easy navigation and manageability.

3. Subsequently, I coded data and label themes that corresponded to the evaluation.
4. Finally, I interpreted the data.

The exploratory thematic content analysis is an inductive approach that is associated with a qualitative inquiry. Its emphasis is on what data arises from the collaboration between the researcher and the respondents or, in this case, the focus group participants and I (Gordon, 2009; Guest et al., 2012).

The goal was to divide the information into controllable sections and then do the analysis. This can be accomplished by cataloging the available data. I assembled the information and transcribed the text immediately after the focus group meeting. Exploratory thematic content analysis was used in this study. The main themes were derived from the data. This process involved transcribing the obtained information and going through the transcript content line by line to identify meanings and to categorize their patterns, based on the emerging themes (Saldana, 2013). The transcription revealed terms and phrases that appear repeatedly. I coded the transcribed data and determined its frequency by reading the texts several times and transcribing it manually.

I ensured effective data analysis by answering the research questions, and by identifying activities that lead to the desired outcomes. I employed four structural elements that helped in achieving the anticipated results (Guest et al., 2012).

First, I noted the attributes of the participants where responses to research questions were sought. The second structural element I employed was collecting information from the participants. Third, the interpretation of primary data led to

secondary data, which included links between information and codes, definitions, notes, summaries, and diagrams (Guest et al., 2012, p. 46). Lastly, I used digital representation, such as sound or graphics that can emphasize and add to the information in the database, making results more useful and dependable (Guest et al., 2012).

Diagrams such as the futures wheels played a part in visual information and data analysis. For example, responses from participating groups were written, monitored, and recorded in a proper location on the futures wheel. The information was then assessed for frequency and data saturation (Onwuegbuzie, Dickinson, Leech, & Zoran, 2009). I kept in mind that the process of data analysis is active and collaborative. The distance between the research question and the answer was not a shortcut, but a map of trustworthy information that can be explored by other researchers (Guest et al., 2012).

Trustworthiness

To ensure trustworthiness, I followed credibility, transferability, dependability, and confirmability. One of the measures was the internal validity by which the researcher ensured that the study remains true to what was proposed. Securing credibility was crucial in establishing trustworthiness (Guba, 1981). I implemented several requirements to demonstrate that all the phenomena were properly recorded:

1. I researched established methods.
2. I familiarized myself with the participants' culture without getting caught up in it.
3. I implemented purposeful sampling to invalidate bias.

4. I triangulated and used approaches like observation, focus groups, and questionnaires in my data collection.
5. I made sure participation was voluntary.
6. I applied repetitive questioning, to expose lies. I rephrased questions so that the inconsistencies become clear.
7. I used negative case analysis to address all matters.
8. I employed recurrent debriefing when other investigators brought their experiences to the project.
9. I encouraged a peer review of the research.
10. I used "reflective commentary," to evaluate the research as it developed.
11. I acknowledged that background, credentials, and knowledge of the investigator are essential in my study.
12. I relied on detailed descriptions to convey real situations, and their meaning.
13. I examined earlier findings to enhance veracity. I showed that my outcomes were compatible with those of previous studies (Shenton, 2004, pp. 64-69)

I was concerned with external validity to which my study's findings can be applied (Shenton, 2004). In this manner, transferabilit*y* concerns were applicable with the findings of a broader population. However, two opposing views may have affected me. The first is that the findings in one study do not necessarily apply to other populations and circumstances. The other is an example of a broader group where the transferability should be excluded (Shenton, 2004, p. 69). Nonetheless, it was my responsibility to

safeguard enough contextual information about the research site and process to allow for others to repeat the process.

It has been shown that repeated work in the equivalent setting, with unchanged methods, and participants may yield comparable results. There are close ties between credibility and dependability, which were achieved using a focus group and questionnaires (per Shenton, 2004). I described the study process in detail, enabling other investigators to replicate the analysis. The examination became a sample model, and its coverage followed an identifiable research tradition (Shenton, 2004). Dependability enabled the reader to understand the methods and effectiveness, achieved by: (a) design and execution, (b) the information assembly, and (c) an introspective assessment of the undertaken processes (Shenton, 2004, p. 72).

I did not associate objectivity with human ability and insight, because human designed tests may be biased. To this end, I admitted my own susceptibilities. I adopted, reported, and explained within the investigative report the reason for choosing one approach over another. I also disclosed weaknesses (Shenton, 2004). In this context, confirmability will foster objectivity and insightful explanations. An observer should be able to trace the progress of both the decisions and the procedures.

Ethical Procedures

The participants were seniors from a senior center located in New York, experts from engineering society, and family members of the cognitively impaired elderly. Participants were informed about the study. An announcement at the senior center was made in the institution's newsletter/activity paper. Participants were asked to sign up for

a voluntary study. Assistive technology experts were notified via a listserv hosted by L-SOFT website reserved for the cognition and sensory loss members. Invitations were emailed to potential participants, requesting them to reply via the link and email the responses back to my email address. Similarly, university's participant pool was notified about the study via the university's participant pool for research studies. Online participants could freely choose to participate in the study or withdraw from it once they began. The consent form also explained (a) the background information, (b) the data collection procedure, (c) the voluntary nature of the study, (d) the risks and benefits of being in the study, (e) the payment, (f) the privacy, (g) the dissemination, (h) the contacts and questions, and (i) the statement of consent. Also, the focus group received a protocol (Appendix A) that was given to the participants before the scheduled focus group meeting.

To safeguard collected data, all written, printed, and recorded information was stored in a safe at my house. The obtained information was also stored on a hard drive of my computer and on an external flash drive. Both will remain locked in the cabinet located in my house. I am the only person with access. The study participants, if who, they request it, will have access to the digital files. All information linking the names of the focus groups participants were removed from the analysis, and the transcripts, before sending them for validation.

The participants were at minimal risk. I conducted the research to fulfill a requirement for a doctoral degree. The informed consent note emphasized that the information provided during the focus groups was depersonalized. The focus group

protocol (Appendix A) had a coded identifier rather than a member's name to minimize the connection between member and response.

Summary

The qualitative method was chosen for this study because it supported a deeper understanding of issues while fulfilling the why-and-how of inquiries. It also embraced the push, pull, and weights of probable futures. Causal layered analysis with its four layers and a futures wheel were discussed.

The participants, the seniors from a senior center in NY, engineering society experts, and the university's participant pool took part in this study. I had no personal or professional relationship with any of the participants. My role, as researcher, and my efforts to reduce bias were discussed. I also addressed other ethical issues concerning incentives, conflicts of interest, and participants' freedom to pose questions.

Thematic content analysis was chosen because of its data-based themes, and categories, plus its development capabilities. I selected purposeful strategy sampling because of its statements from the participants. I supported my study by verbal and written protocols. For confidentiality reasons, I assigned a number to each participant. I encouraged the participants to be creative and open-minded at all times. The note taker helped with document completion and tape recorder ding. All data were labeled and transcribed to ensure the trustworthiness and the ethical procedures involved.

Chapter 4: Results of the Study

Introduction

Cognitive impairments caused by Alzheimer's and dementia have global future health and socioeconomic impacts. Thus, there is growing attention on AT solutions for the cognitively impaired elderly. A range of new technological innovations are being developed to monitor the safety, health, and welfare of the cognitively impaired elderly that incorporate environmental sensors, audio and video technologies, as well as advanced integrator sensor systems (Gladman et al., 2012).

The purpose of this social construction qualitative study was to explore the possible futures of AT in the lives of the elderly who suffer from Alzheimer's and dementia. AT innovations can improve the quality of care as well as the life quality of the caregivers, especially when they share living quarters. This futures research may eventually help delay the need for long-term hospital care and promote independence by evaluating the effectiveness of AT for the cognitively impaired elderly as health care and policy decision-makers become aware of the results. This qualitative study adds to the academic and general knowledge about AT's ability to provide daily maintenance of the elderly.

The central research question that this research answered was: What are the alternative futures of assistive technologies for the cognitively impaired elderly, 65 years old and older, by 2037?

The subquestions are:

1. What are the implications for major trends in health care services, demographics, and in other major driving forces of change in AT?
2. What are the forces of resistance, myths and metaphors, and narratives surrounding AT?
3. What are the probable, possible, and preferred futures of stakeholders in AT?

Chapter 4 includes relevant information about the participants and the demographic make-up of the focus group, as well as engineering society experts who responded to the questionnaire. Chapter 4 also presents details on the data collection strategy. The results are detailed, including emergent themes. Evidence of trustworthiness is examined.

Study Setting

The recruitment and selection process took three months. Each participating site took two months to provide permission to conduct the study. Managers of the first New York assisted-living facility I approached declined an invitation to participate. I contacted a dozen other assisted-living facilities by mail. Most did not respond; several had moved out of state.

Although professing their support for Alzheimer's and dementia studies, the Alzheimer's support groups that I contacted declined to participate. Public and private libraries also declined, citing privacy laws. Most senior centers did not respond to my requests. One Queens, NY, senior center did express interest but could not recruit enough seniors to participate.

In the end, one senior center gave their permission to conduct the focus group. The date was set two months later. The second site, a professional engineering society, took several weeks to post the questionnaire. The engineering society has several specialty groups directed by voluntary chairs and co-chairs, which made logistical coordination difficult. Because the assisted-living facilities declined to participate, I filed a request to change the procedure with the University's IRB. In place of the assisted-living facility, Walden University's participant pool was introduced into the study.

Finally, permission to conduct the focus group was obtained from the New York senior center's central office. The seniors for this social construction qualitative study were recruited via a flyer and the facility's activity paper. The flyer and the activity paper announced my name as the facilitator, the purpose of the focus group, the date and time, the length of the focus group, the name of the university, and the dissertation title. Ten seniors from the New York's senior center volunteered to part take in the focus group. Purposeful sampling was used to recruit a mix of male and female participants from varied ethnic backgrounds. In the focus group, participants reported on their personal beliefs, experiences, and obstacles to AT for the cognitively impaired elderly. The contributors responded to inquiries related to the research questions (see Appendix B). The focus group was 90 minutes long.

The second group was recruited through the engineering professional society and comprised of the country's engineering experts in the field of AT. The first official contacted was a cognition and sensory loss chairperson who gave me permission to post the questionnaire on her group's listserv. A consent form included a short study

description, background information, data collection procedure, nature of the study, risks and benefits, payment, privacy, dissemination, contacts and questions, statement of consent, with the study's SurveyMonkey link. Subsequently, educators, occupational therapists, engineers and technologists, speech and language pathologists, international, and vocational rehab chairs were invited to participate. Sixteen accepted, but only fifteen posted answers to the 10-question questionnaire (see Appendix C).

With my dissertation committee chair's permission, I assembled a third group from the university participant pool. The participant pool comprises a large and heterogeneous population of university faculty and doctoral students who respond to their colleague's surveys and questionnaires. A consent form that included a short study description, background information, data collection procedure, nature of the study, risks and benefits, payment, privacy, dissemination, contacts and questions, statement of consent, and a SurveyMonkey link. Participation was limited to those who have or who have had elderly family members with Alzheimer's or dementia. They answered the SurveyMonkey questionnaire (see Appendix B).

Participants Demographics

The demographic breakdown of the three groups was as follows. First, the 10 participants from the senior center focus group included five White males, three White females, one Asian female, and one Black female. While the focus group was well into the session, one Black female walked in, sat down for a while, but did not participate and left shortly after. I assumed most of the senior center participants were 65 years old or older. Participants were given refreshments.

The second group consisted of 16 engineering society AT experts who participated in a SurveyMonkey Web-based questionnaire. Although the demographics were unknown, the participants are members of an American professional society comprised of several hundred male and female work-aged individuals.

The third group from the University participant pool included five participants from the school's faculty and doctoral student body. Demographics were unknown.

Data Collection Procedures

In the spring of 2018, the focus group took place in a senior center in New York. The data collection method was a face-to-face focus group participation and observation. The participants answered questions I created (see Appendix B). The Futures Triangle Analysis served as the macro outline, specifically, to identify the "pushes, pulls, and weights" of change on the phenomenon under study. The focus of the causal layered analysis was to identify the various layers of the phenomenon: litany, social forces, worldview, and myth and metaphor. The smart board, my laptop, and a new PowerPoint slide projector did not work that day; instead, participants read questions aloud. Audio recording and handwritten notes (my wife, Patti took notes during the session and helped identify participants in the transcription process) were used to collect data from the 90-minute focus group.

Purposeful sampling was also used to obtain data from the engineering society experts. A consent form that included a short study description, background information, data collection procedure, nature of the study, risks and benefits, payment, privacy, dissemination, contacts and questions, statement of consent, with the study's

SurveyMonkey link to the questionnaire was introduced (see Appendix C). Sixteen anonymous responses were obtained. The first three responses arrived within the first week, another 10 in 2 weeks, and three more in the last week, before closure.

Five members of the university participant pool replaced the expected assistive-living facility participants whose participation was withdrawn. The change allowed access to a diversified group of participants who responded to the same questions posed to the focus group. The participant pool enhanced and broadened the data collected. The triangulation and the sampling methods remained unchanged from the process proposed in Chapter 3.

Data Analysis

The variance of the inductive approach was "the official future:" the future that we believe will transpire, either explicitly or implicitly (Ogilvy & Schwartz, 2004, p. 4). The focus group and the SurveyMonkey questionnaires were coded according to the exploratory thematic content analysis. The main categories and themes derived from the data. This process involved transcribing obtained information and then going through the transcript content line by line to identify meanings and to categorize their patterns (Saldana, 2013). I coded the transcribed data and found frequencies by reading the texts several times and transcribing them manually. A number of themes emerged from the initial data coding. For example, the ideas of *independence* and *control* – as in the desire "to take responsibility for yourself" and "to do everything herself," appeared in the transcripts. Additional themes emerged, including:

- impairment

- longevity/lifespan
- health policy
- AT futures
- providers and
- generations

I ensured effective data analysis by answering the research questions and by identifying activities that lead to the desired outcomes. I engaged four structural elements that helped in achieving the anticipated results (Guest et al., 2012). First, I noted the attributes of the participants where responses to research questions were sought. The second structural element I employed was noting information gathered from the participants. Third, I interpreted the primary data, which led to secondary data including links between information and codes, definitions, notes, summaries, and diagrams (Guest et al., 2012, p. 46). Lastly, digital representations, such as sound or graphics were emphasized, and added to the information, making the results more useful and dependable as recommended by Guest et al. (2012).

The primary focus group themes within the categories included CLA's four levels of understanding: litany, social causes, discourse/worldview, myth and metaphor. The first, litany, stands for day-to-day short-term views and became the dominant theme throughout the session and continued to be central in eight out of the 10 questions asked in the questionnaires; outliers were Questions 8 and 9, which governed the social causes level. Litany also encompassed the first four focus group questions.

Question 1 asked, “What specific technologies [list] or innovations do you think would be most beneficial to assist the cognitively impaired?” One answer was, “Bigger buttons on everything.” The focus group agreed that they have problems with long instructions and buttons that are small, but bigger buttons and devices may cause the technology to become expensive. A short-term memory loss was mentioned, and that it was expensive to received help. One senior stated, “If you are the one working physically and helping, the damage is being done cognitively.” Another said, “We need equipment that can be rewound or repeated [and we should be] involved, hands-on, touching, seeing, and hearing, not to be disoriented or get lost.” In my role as moderator, I mentioned shoes with GPS that can guide someone home or to the destination. I prompted the group that technology does not have to be expensive.

The university participants’ answers to the same question included a list of: a senior citizen devise voice activated that pulls up family members’ pictures by name, computer, gaming system, smart phone, emergence applications and services, and fun interactive games to improve memory. Thus, control, independence, impairments, and AT were the dominant themes in both groups. These themes offered more insight into the social needs of the older adults. Technological assistance should be centered on seniors’ staying involved and participating in activities.

The second litany-level question was, “What functions [senses, abilities] should new technology provide to assist the cognitively impaired?” Answers varied. One participant noted that it was important that instructions are repeated many times. Another participant noted the importance of technology for constant monitoring, supervision, and

other types of support, and another participant responded that AT could provide physical support and hands-on care, such as with advanced robotics. But, another senior added, "many times a person has a physical disability and it is difficult to get all of the parts together at one time. Many of them want to do everything they can for themselves." Interestingly, one senior thought that multimedia should play a role in a learning process.

The university participant answers also varied and included the importance of hand-eye coordination in the elderlies' everyday activities. The inability of quickly grabbing a hand railing to prevent a fall was mentioned as a leading cause of injuries among seniors. One respondent thought that resourcefulness, being able to access information independently was important. The participant wrote

> My 91 years old mother loves her laptop and researches all sorts of things on the Internet – not mention sending me emails. Her brain is sharp, and she is engaged. Neither of her two sisters – one 2 years older, the other 2 years younger – use a computer. Both are increasingly becoming cognitively impaired. The ability to problem solve keeps the brain sharp. A gaming system could be useful in providing eye-hand coordination.

Accessing information independently, eye-hand coordination, simplicity of gadgets, and devices that include audio and video capabilities were listed. Staying active and being engaged played a big role in the participants' responses.

The third litany-level question was, "What are the challenges or issues that face the cognitively impaired that technology might potentially address?" The answers fluctuated between seniors wanting funding for state programs, social and physical

stability, and exercises. One senior said they need a device reminds them of things. “We need smart devices.” One participant noted that Ronald Reagan had Alzheimer’s for 10 years but that he had help. One senior stated, “Alzheimer’s is progressive. I was losing my husband for over 15 years, but he knew how to hide it.” Another participant said, “They get embarrassed. They are paranoid” and a participant noted that an interactive device could help with these challenges.

The university pool participant agreed that frustration and the feeling of forgetfulness should be addressed with and by AT. Another wrote “I think the use of virtual reality can help train the elderly and practice basic every day movements that we normally overlook, like cutting vegetables or driving a car.” A laptop with Microsoft Office applications can be used as a reminder of how to connect to the Wi-Fi or to send an email stated another. Technology that provides independence from cognitive impairments, the ability to access information, and connectivity were the major categories listed by the participants.

The fourth litany-level question was, “What are the challenges or issues that face the caretakers of the cognitively impaired that technology innovation might potentially address?” The theme that surfaced in this question was a prelude to the elders’ self-identity and continued independence. One of the participants complained about increased insularity, memory loss, withdrawal from society, and anxiety. Others joined in and told stories about husbands not eating, mind clutter, self-preservation, personality changes, and the inability to have enough money for medication. The participants agreed that music was an important part of the daily routine.

The center's seniors talked about the importance of patients learning how to use interactive smart devices and the importance of their relationship with the cell phone. Some of the seniors thought that technology might help seniors to remember. One senior stated [neurotransmitters] such as serotonin, dopamine, and acetylcholine delay the symptoms. Another said "stimulation of the head" was the future. One of the participants suggested that technology should prepare the caretaker for the task of caring for someone. "I have not seen much progress in care and testing for Alzheimer's" The university group responses included a participant's comment that AT could save money and support groups and other social services are important to address the "burnout" issues. Also, some said that smart phones that could remind a person when to take a pill were essential. One respondent summed it up by saying "being able to follow instructions and organization. Smart phone and be equipped to remind someone when to take a pill or example. A computer with Skype could allow a caregiver to connect them with relatives anywhere, thus providing happiness and joy – an essential to well-being." There appear to be considerable agreement about the importance of the themes that emerged: independence, connectivity, impairment, AT, health policies, providers, and control - all of which consistently recurred in answers to the first four questions.

The fifth question and the first in the causes of issues level was: "Which driving forces [show list: economy, environment, demography, globalization, social, political] will be the strongest to encourage new AT innovations?" The economy was the number one concern for all 10 participants. The Americans with the Disability Act (ADA) was cited as a possible political force. Politics was the distant second driving force. Several

seniors commented on the “cost of things” and free libraries that people do not go to anymore because they have the computer at home.

The use of herbs was mentioned, and the positive impact of turmeric on combating dementia in the South Asian population. One less positive senior remarked sarcastically, “But the South East Asians do not live long enough to get dementia,” and that fruit supplements that supposedly improve the immune system are bogus. Politics mixed in with the economy was blamed for not finding a cure for cancer. The media for indoctrinating the public into believing that what the media sees is the truth. Distorting the publics’ judgment and affecting their behavior, said another.

Research and the development of technology was the next topic that arose. The word “innovation” was mentioned several times. The participants thought that innovations can bring more jobs. But independence and empowerment were often the dominant subjects. For the university pool participants, the economy also topped the list of driving forces. The biggest factor was the overall affordability of new technology for the average person. The use of new technology could help drive the cost down of age-related care expenses, decrease stats of certain illnesses, and increase the quality of life, according to one participant. Both, the focus group and the participant pool groups agreed that the economy, AT, independence, and control over our schedule, what we eat, where we work, and who we support politically is fundamental to our lives. The economy was chosen because according to the pool participants, “Economic incentives are key to research and development. Profits drive innovation. Socially – friends and relatives make good salespeople who would encourage someone to embrace new technology. Political

groups could provide a source of funding and support" wrote a participant. Economic potential is the driving force in Silicon Valley, said another. "Economics would probably be the biggest factor in terms of the overall affordability of new technology for the average person" was the last response.

The sixth question and the second in the causes of issues level was, "Which driving forces [show list: economy, environment, demography, globalization, social, political] will be the strongest to resist the adoption of new assistive technology innovations?" Once again, politics was blamed as the biggest impediment to change and innovations by most participants. The consensus was that sensitivity toward the American population will create jobs and money. One university participant thought that statistics could be manipulated, and long-term solutions could be problematic. Another participant though that "globalization would be the strongest to resist the adoption of AT innovations because of third-world restrictions." Another person blamed both, the economy and the demography, stating that both will make technology expensive. Control and policy were the dominant topics of the conversation.

The seventh question (the big picture: what we think is real or not) in the worldview level was, "Are new technologies [show list] more helpful tools, anti-human objects, or tools that change humans as they modify their tools?" The question was not understood at first. I posed an additional and eighth worldview question, "Is the future like; a game of chance? A roller-coaster? A river? What do you think is coming? Do you think it is a roller-coaster, ups and downs? Do you think it is an ocean of things, and you

can't see out there? Do you think it is a river; is it a stream that keeps going in the same direction? What do you think?"

The first person who responded thought it is a combination because "there is [sic] going to be ups and downs," that is, the roller-coaster: People are unpredictable, and the risk is going to be higher and higher.

Another thought it was the river but stated "we do not know what is coming, there could be rapids." The same question was read again. I redirected the participants by saying that technology could be the most amazing thing that has ever happened. This is how progress is made. But there are many others who think technology did not get us very far, and that it pollutes the earth. Look at computers, discarded once dumped pollute the planet. One participant's comment was "they are not biodegradable." "I also think technology is a curse to interpersonal communication." Another opposed that idea by saying "it is not a curse, I am fine with technology because I am very independent, but it is hard to communicate with people, we communicate via machine. Email is the same thing. There is no going back, it is impossible, but voices for face-to-face and personal connectivity were also formidable." Thus, control over one's life was again a noticeable theme for the focus group.

The concept of young people being unfocused and confused about where and when to use technology became the next topic of the focus group. People complained about being hit with sweaters and even cars because the driver was texting while driving. One said, "They are out of it, unconscious." Another said, "They are not interacting with you." One senior declared, "I do not have a smart phone, because it brings on anxiety,

and I don't have a younger person in a family to help me with the phone." Thus, the level of generational familiarity with technology, re-surfaced. Its positive and negative usage was questioned by the elder participants. The positive included the ability of instant communication with family and friends. The negatives lack of empathy, and human warmth from those who use it excessively.

I noted that even doctors when texting do not see five feet in front of them and bump into patients. The participants' answer to that statement was that "technology is perfect. It is the people who are irresponsible. The problem is an over-dependence on technology. We throw away, and forget what we do know, because we have technology." Others opposed that view, saying "There have been studies done. I read on my Kindle, instead of reading a book. My Kindle is my technology." One of the participants declared that you cannot stop progress.

Questions 7 and 8 were merged. Worldview (the big picture – what we think is real or not). Are new technologies (list) more: helpful tools, anti-human objects, or tools that change humans as they modify their tools? Was combined with [Show of hands] Is the future most like: a game of chance? A rollercoaster? A river? An ocean?

The first senior responded by saying "it is a combination, there is going to be ups and downs. That is the rollercoaster. There is going to be, you know, risks, people are unpredictable." Another focus group participant said, "I see a river." A river that you don't know what is coming out there. There could be rapids." The rollercoaster scenario collected the most votes, followed by a river, and a game of chance.

University participants' answers varied from nothing can replace the human touch, to, dependency on a cell phone, and detriments of technology, to personal problem-solving skills. Others thought that it is a combination of helpful tools, anti-human objects, and tools that change humans. Another thought "historically new technology has proven to be a boom for some individuals and industries. It also led to the loss of many manual jobs and huge changes in other industries." Thus, assistive technology, and the dependence on technology were the predominant categories in this part of the discussion with seniors, and the questionnaires participants.

Number 9 suggests (the first in the "myth and metaphor" level) that the doctor knows best. The question was, "What are the stories, narratives, and myths in your community about technology and the role of technology in society? Positive ones? Negative ones?" Most of the responses called for the proper use of technology. "There is an exaggerated belief that technology can do everything," one senior declared. The phone over email was the preferred method of communication by the focus group participants. Another senior stated, technology can be great:

> [But] you could be very annoyed. Yes, it can be annoying. Let's not forget abusive, the anonymous bullying that goes on. And the other thing, kids today can barely write their name. They can't print, add, subtract, multiply, and divide, because they have their little calculators. It is pathetic. They were trained to follow the machine; they are not using their brain; they are not teaching them anything useful. They all depend on technology (Focus Group Participant)

One university participant response was that only the young can learn to use and operate technology. Other participant thought it is a "myth that technology makes life easier. Fact, it simply allows you to do twice as much in the same period of time" or "that most jobs will be performed by robots and computers, making humans needed less and less." Another stated "Mixed. In San Francisco it favors the positive. Money and jobs are all around, hope is everywhere, and fear is short term." The generational gap was evident. Some participants seemed to be annoyed by technology, others in favor of it. However, being in control of technology was reflected in the answers of many participating.

Question Number 10 called for "stories, narratives, and myths in your community about medicine, health care, and caregiving as related to assistive technologies."

One focus group participant said, "Doctors do not want to educate us or help us. When I ask questions, they insult me by saying I can't answer that question because you are not a doctor." The opposite was true for another senior who was pleased with his doctor taking half an hour to explain the problems. Another senior complained about a 30-, 60-, and 90-day supply of medications and her pharmacy's prices. The issue of technology was raised again, and the consensus was that technology gives a false sense of security. One senior commented that patients think they know more than a doctor because of what they see on the Internet.

Another complaint was that "young people live reckless lives, getting into stupid accidents, because they are talking, yakking on the phone, they don' look up to see the car coming." Technology is addictive, stated another. Another complained that two

doctors gave two different strengths of medication for high blood pressure, about its side effects, and about out-of-date medicine.

Doctors are forced to computerize their records, said another:

> It is in hospitals, private practice, so when you sit down with your doctor he is looking at the computer screen, and then he spends a lot of time at the computer, and then he walks you to the door. You don't have time to interact. So, when you get home, you type an email to your doctor." And "who knows where this information is going, Russia, drug companies, the CIA, and maybe North Korea.

Contrary to what the seniors said university participants suggested that U.S. health care is the best in the world, but worried about its rising cost. The narrative also included new technologies and innovations' great potential for improving the overall quality of life and life expectancy. Once again, AT, control, independence, impairments, and health policies were of outmost importance in the focus group and in the questionnaires responses. Both groups; the seniors and the pool participants who answered the same questions, thought that education, communication, and behavior required more attention and guidance.

Expert Opinion

Sixteen participants answered the expert questionnaire. One person answered only the first question and did not continue. The first eight questions fell in the litany level; the remaining two, in the social causes level. The first question was "Rank the top three technologies that you feel will best support aging-in-place by 2037." The environmental sensors were the number one technology, intelligent assistive technologies placed second, remote mobile monitoring third, followed by biosensors, video and audio,

ubiquitous computing (computing made to appear anytime and anywhere) or pervasive computing (embedding microprocessors in day-to-day objects), robotics, and other technologies placed last. The ranking confirmed my knowledge and understanding of the phenomenon. However, the low standing of wireless communication, and networking (ubiquitous and pervasive) technologies and robotics came as a surprise. But can be attributed to its emerging trend.

Question 2 was: “By 2037, to what extent will assistive technology sensors be able to comprehend and react to a situation the way a human would?” Answers varied from, assistive technology sensors will react similarly to humans, through assistive technology will be able to handle details like "who to call" or "what to do," but, “won't be able to read body language”. The “ability to express compassion, love and respect are human traits.” This researcher thinks that with the development of new chips we will expand the capabilities of computerization. Sophisticated thinking devices will be developed and installed in robots. They will be able to react to a situation the way a human would in the near future.

Computers will be more adept than people, stated one participant. Others rated AT from limited to medium to high. One participant thought that AT sensors would be so advanced that hundreds of typical human situations could be computer stored, and problem-solving solutions could be adapted to individual circumstance. Significant assistance in monitoring health status remotely was a technological option. The standard of care is constantly evolving; human delivery of care will still be superior for the next 20 years said another participant. The opposing view was that “our healthcare system is in

chaos with no improvements across a wide spectrum of care." Another thought that AT is coming, but not affordable or accepted yet. This researcher thinks that AT will become inexpensive and popular. The lonely elderly and the cognitively impaired will be the beneficiaries of the social companion robots who will be able to safeguard the house, do the chores, and keep company to the elderly with health issues.

Question 3 was, "How will new technologies like stem cell, gene therapy, and assistive technologies provide protection from cognitive impairments such as dementia?" One participant thought new technologies will be slow in coming. Another stated that cellular therapy will not prevent causes of dementia, but that AT will improve the delivery of care, coupled with new medications. Others were more optimistic and said that AT will provide more protection than at present but not completely. Another participant declared that detection, prevention, treatment, support, and alternative brain perfusion were the answers. Another said that protection from cognitive impairments should be research-driven by training and relearning the brain. Stem cell and gene repetitive behavioral therapy were offered by the next opinion. Others declared that dementia would never be fully cured, but at least new technologies and treatments will delay its onset. This researcher thinks that regenerative stem cells could replace neurons damaged by Alzheimer's or other neurological problems. AT and a small telepresence robot will provide additional protection and companionship to people with dementia. More promising treatments and therapies are coming.

Question 4 was, "How will intelligent assistive technologies sense and act in response to elder users' physical and cognitive deficits?" One participant thought voice-

activated, wearable, or implantable devices, connected to the cloud could help. Another thought that over the next 20 years, we will see huge advancements in automated personal assistants that will help detect and respond to the needs of seniors. I expect that they will be able to monitor and sense and act in a humanlike manner by then, said another.

Another participant thought that there is no replacement for human interaction. Another believed that compensating for tremors, error responses, providing safety, adapting to the environment, alerting, and providing instruction will be the AT reaction in response to the elders' deficits. Recognizing specific conditions, fall sensors, lights, doors, weather reminders, and notifying caregivers will be done by AT. While it is apparent that a robot cannot replace human interaction, where there is no likelihood of human care, a friendly robotic creature is better than nothing at all. One day the robots will also analyze human implantable sensors and make corrections to a flawed human condition.

Question 5 was, "What types of implanted sensors used to improve, and measure health parameters will be popular (or in demand) by 2037?" One responding expert is in the process of developing a wearable and perhaps implantable AT for cognition, such as memory, planning, and judgment. Other expert participants cited ripe opportunities for AT for vital signs, medication adherence, blood sugar, pressure sensing, seizures, tremor, heart, vision, hearing, and sleep monitoring, respiration, and bowel and bladder incontinence. Another thought that all this sounds very "Big Brotherish," and only sensors can provide real-time data for health management. Another reasoned that the

United States government will allow HMOs to invade privacy and independence. The participants turned question five into a health and policy issues. The answers ranged from, this is the right time to be developing new ATs to health policies issues. Reaffirming the vital role sensors and cognitive aid devices will play in people's lives.

Question Number 6 addressed what cognitive orthotics (cognitive aid devices) would assist cognitively impaired elderly with cognitive tasks and memory assistance. One participant stated that she is developing a "customizable planner," a scheduler specifically designed for individuals with cognitive impairment or decline (from a medical condition, trauma, or age). Another pointed to robot-like assistants, smart technology, and multiple platforms that can be run from the high-end PC. Voice/visual or wearable reminders or timers were also cited.

Participants also discussed building beneficial actions and avoiding harmful ones, auditory and visual auto reminders or cues, and parameters that can be set for independence within home environment or in other environments. They also mentioned repetitive messages for reminders of food, medicine, and task focused-prompters with dynamic context awareness. The negative voices among the participants opted for the non-internet connected devices, believing the internet infringes on privacy.

Question 7 was phrased, "At what point will context-aware computers capable of determining the environment (triggering a reminder or dispensing an intervention) become an integral part of the elderlies' daily support system for those with cognitive or physical impairments?" The respondents thought that by either 2025, or 2030, context-aware computers will be widely used by the elderly. Others stated that the system already

does this today but is dependent on Wi-Fi, and other sources, especially in rural areas. So, back-up systems and supports are needed. Affordability and insurance coverage were an issue. We were told by the participants that digital pill dispenser reminders, and door sensors, that speak to the elderly about their whereabouts already exist.

Question 8 was the first of two questions that addressed the theme of social causes level. Question 8 was, "What events will render patient-centered home-based systems, the foundation of the health care system?" The answers were centered on the availability of cost-effective, reliable technology. However, continued reductions in reimbursements, shortages of certified nursing assistants (CNAs), and direct support professionals (DSPs), made long-term care (LTC), and nursing hospitals a booming business. Home-based care will become ideal with continued transportation and funding support. Thus, respondents' main objective was an overhaul of health care with an emphasis on home care and equipment. Funding and outcome studies have also shown that home-based systems provide cost-effective controls over the health care system.

Question 9 addressed the types of legal and ethical issues that will arise in the next decade to prompt an increase in the use of intelligent AT tools. The first response centered on privacy, and users' competency to have monitoring assistive devices. Revised advance directives will likely be needed. Implants should always be optional, without government interference. The application process quick with privacy, and personal freedom protected, where backdoor access to personal information will not occur. Participants predicted fewer lawsuits and noncompliance interventions by HIPAA. There will be more compassion and caring in health care and palliative care and data will

not be manipulated by the government. There might be an issue with equal access for all people to the latest medical treatments and technologies along with a lack of funding for human assistants.

Question 10 was stated, “If clinical trials demonstrate the medical efficacy of assistive technologies, when do you think insurance reimbursement for the purchase of technology will become a reality?” The answers to this question were mostly pessimistic and varied from “never” to cynical remarks such as, “Health insurers have no interest in returning an individual to functionality.”

> Insurance providers barely provide services to maintain life. I have been providing assistive technology for cognition to cognitively impaired individuals for over 25 years; no progress has occurred with insurance provides. I do not see this improving until 2050 or when legislation forces them to pay for prevention and support.

Other participants thought that savings will have to outweigh current expenses or when such “technology can demonstrate its cost effectiveness for insurers” and other segments of the health care industry. To others, this was a gradual process that requires a few years to mature or when such “technology becomes more commonly used.” Knowing that medical and scientific innovations occur more rapidly now. Others thought that there is already a body of literature demonstrating efficacy, but funding is still the primary barrier to the daily usage of AT.

Assistive Technology Alternative Scenarios

In this section, I employed CLA to develop alternative futures of AT for the cognitively impaired elderly. Table 2 is a matrix (see Table 2) of the four scenarios, and table 3 outlines (see Table 3) the alternative scenarios.

Table 2. *Matrix of Scenarios*

Happy retirees	Struggling pensioners
Most desirable	Least desirable
Caring robots	Youthful aging
Most likely	Emerging culture

The CLA assumed four levels of analysis in the development of scenarios: litany, social causes, discourse/worldview, and myth and metaphor were the key images. The scenarios take place in 2037 and were structured by the most desirable, least desirable, most likely, and the emerging culture models. The futures wheels helped identify and organize the primary, secondary, and tertiary outcomes information (Glenn, 2009). Futures wheels informed me about the underlying forces of change. The goal was to plan and build a structure around unsystematic thinking and assumptions (see Table 3).

Table 3. *Outline of Alternative Scenarios*

Outline of scenarios	Futures of aging, and assistive technology
Most desirable "Happy retirees"	
Litany (Day-to-day, short-term view)	Growing population of the elderly
Social causes of issues	Loneliness
Discourse/Worldview (The big picture – what we think is real or not)	Retirement and financial resources
Myth and Metaphor (The notion of doctor knows best)	End of productive life
Least desirable: "Struggling pensioners"	
Litany (Day-to-day, short-term view)	Aging and technology
Social causes of issues	Gerontocracy
Discourse/Worldview (The big picture – what we think is real or not)	Dwindling resources for health care
Myth and Metaphor (The notion of doctor knows best)	Technology will provide the fountain of youth
Most likely: "Caring robots"	
Litany (Day-to-day, short-term view)	Internet and general accessibility
Social causes of issues	Health policies
Discourse/Worldview (The big picture – what we think is real or not)	Medicare vs. increases in the retirement age
Myth and Metaphor (The notion of doctor knows best)	Set retirement age
Emerging culture: "Youthful aging"	

(table continues)

Litany (Day-to-day, short term view)	Loss of interests and effects of aging
Social Causes (Causes of issues)	Spiritual and physical fulfillment
Discourse/Worldview (The big picture – what we think is real or not)	Technical and scientific innovations
Myth and Metaphor (The notion of doctor knows best)	Aging clouds wits, and unavoidably causes dementia

Backcasting, the reverse of forecasting, was the primary planning method for all four futures wheels. The futures were examined from a specific outcome and then worked backward to the present condition. Backcasting was used in the discovery and scenarios analysis.

The most desirable scenario was based on "happy retirees," as seen by John. The least desirable was Keisha's vision of "struggling pensioners." The most likely was Peter's foresight of "caring robots." Lastly, Vivienne's forethought was the emerging "youthful aging."

Happy Retirees

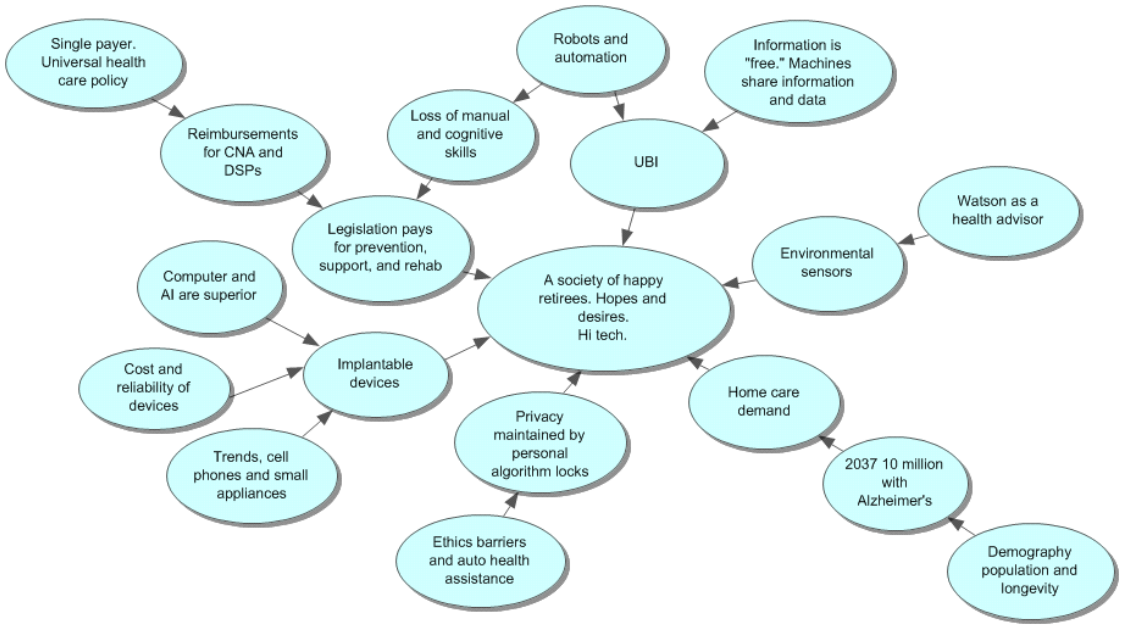


Figure 5. *Happy retirees*.

The 2037 society of happy retirees (see Figure 5) is the flourishing cultural and financial foundation of several nations around the world. The elders are the backbone of the U.S. economy. John thinks that changes in the retirement benefits and health policies were propelled by the growing population of the elderly. Their retirement pensions increased proportionately to the economy. Those with low retirement pay receive supplemental universal basic income (UBI), allowing seniors to travel, eat out, and see their virtual specialist when necessary.

John, who is 65, like most of his friends who are older, successfully monitors his health by consulting the IBM Watson Health Cloud. John and other seniors have full access to their electronic medical records. His visits to a virtual physician are infrequent. In an emergency, medical drones with life-saving equipment on board fly in to help. He

does not like seeing them, knowing they mean that someone is lonely or in distress. Drones quickly disappear into the horizon, their destination unknown.

Sophisticated, unbreakable security programs guard the privacy of medical records. Privacy is still the number one priority, yet no one has heard of a breach in 10 years. That is in part due to younger generations being protective of their medical history and the privacy of their seniors. AIs and robotics have taken over the mundane daily rituals of most citizens, giving everyone time to think about how to reform policies and health care successfully.

John thinks that the 2037 elements of the new health care were known years ago. The transition from a nation-centric configuration to global wellness was not smooth but marked by volatile upheavals. Fortunately, the new approach to AT led to novel treatments of diseases and disorders. The medical and scientific establishment came up with many cures for previously untreatable illnesses, such as Alzheimer's.

The new approach to medicine and technology saved many lives. The 2017 predictions about the shrinking density, and the distribution of Earth population did not materialize, thanks to the globally shared information on Watson's smart medicine and legislation. The lower demand for manual labor and the full automation of many industries became a force. The entire human race had to become tech-savvy.

Consequently, tech-savvy seniors became influential and popular with the younger generations. The active seniors connected with other pensioners, professionally and socially. In spite of the fact that UBI is sufficient for maintenance, most seniors work from home. They do their part in the "save the power act" that prohibits single drivers

from driving to work. Cars, sun-powered grids, and high output electrical batteries no longer pollute our planet Earth. Most of the residue is recycled within the city limits; the rest is shipped to even bigger out of state recycling centers. The concern for clean water and a pollution-free Earth is always there.

Struggling Pensioners

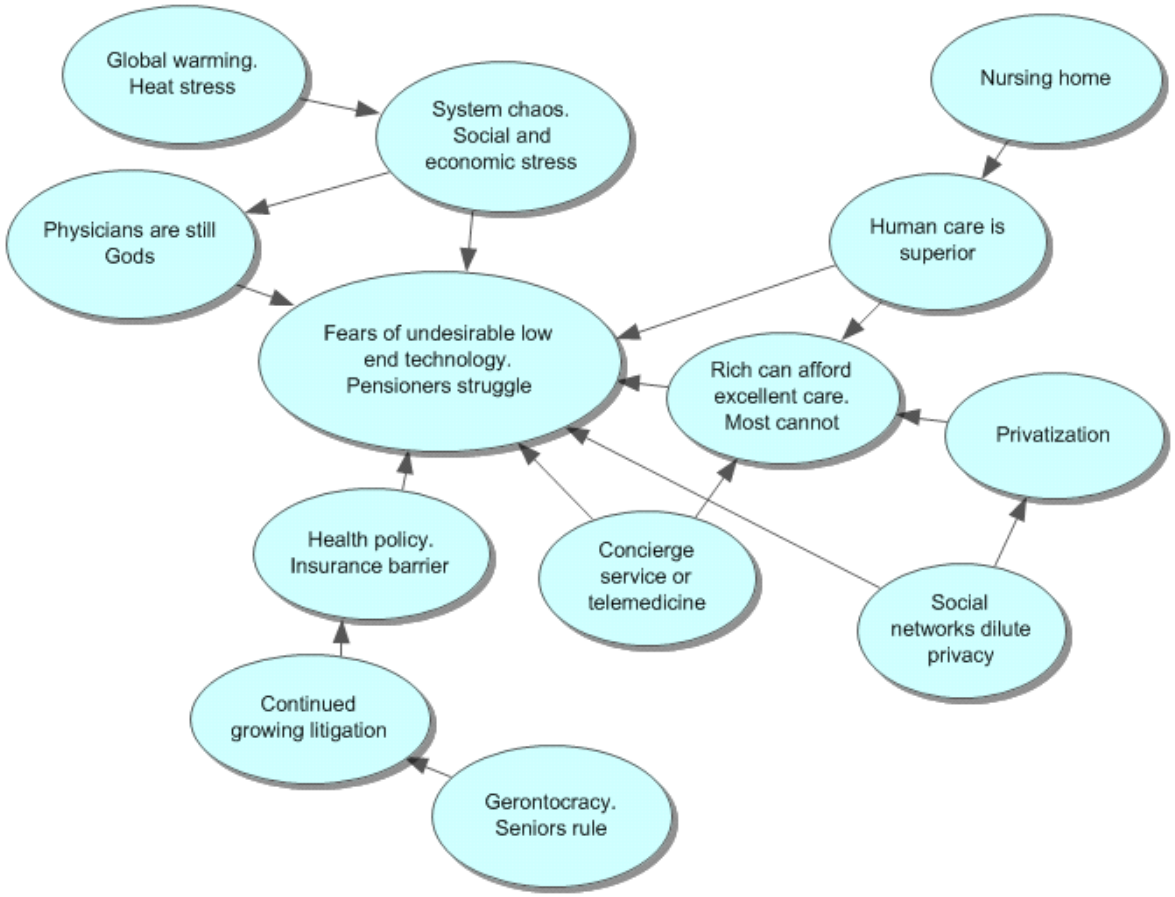


Figure 6. *Struggling pensioners*.

Keisha said she is disappointed with the year 2037 (see Figure 6) election of the U.S. and other nations' right-wing protectionist leaders. There is a constant surge for monetary gains by the wealthy elite at the expense of the poor and the middle class.

Nothing has changed in the last decade. The U.S. economy is in the dumps. The situation has become intolerable for many Americans, many have moved to Canada and to other liberal states.

Low pensions, low social security benefits, no health insurance, and a bleak outlook, suggests a low standard of living in future U.S. cities. The disparaging situation is due to uncontrollable corruption from the top down. Gerontocracy has the reins, preventing progress. Personal and property taxes in 2037 have risen tenfold, yet there is no money for health care or basic research.

Keisha must take her elderly parent to a second-rate storefront clinic and pay out of pocket for tests and services her mother desperately needs. She suspects her mother has Alzheimer's. The drain on her financial and personal life is unbearable. Keisha more and more often has suicidal ideations. Fortunately, her love for her mother keeps her from acting out, but still damages her nerves. Keisha knows only too well the devastating effect Alzheimer's can have on both caretakers and their families.

She thinks that the projected number of individuals diagnosed with Alzheimer's is likely to rise to 13.8 million by 2050 if nothing is done to combat the disease (Alzheimer's Association, 2015). She wants to know how technology can help in the care of the elderly with Alzheimer's or dementia.it is evident that business-as-usual cannot go on. The socio-economic consequences are devastating. The cultural aspect of caring for the cognitively impaired elderly has not changed in decades. Caregivers are either unpaid family members, or low-paid health aids. Keisha thinks the situation is dreadful, making the future for caretakers' bleak.

Caring Robots

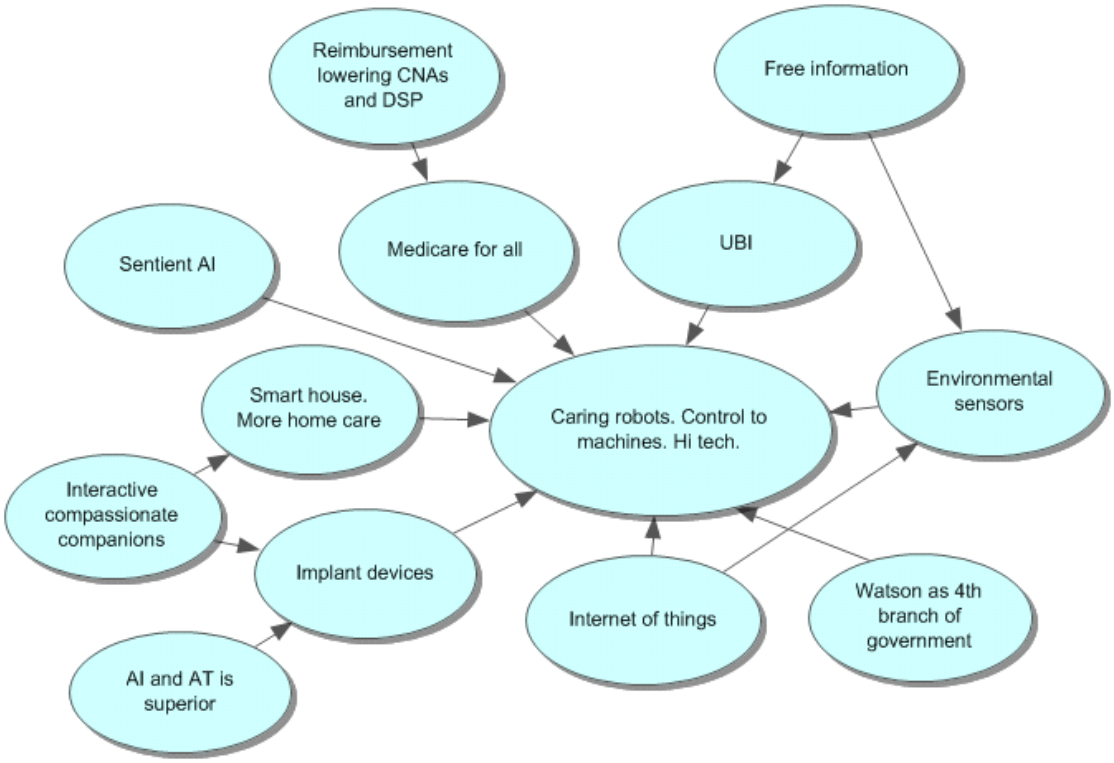


Figure 7. *Caring robots*.

Peter, unlike his friends, is a tech-savvy senior (see Figure 7) who often thinks about the major trends in technology, health care services, demographics, robotics, and other major driving forces of change. He understands the worldview on the Internet of things. Peter knows that the future is unknowable, but he also knows that some things are predictable. He claims that we can identify the rudimentary undercurrents of the future, and plot a middle course, despite the fact that we cannot affect the future.

Peter is convinced that we can influence, shape, and advance our economy and policies by investing even more in the Internet of things. He declared that introducing

new technology based on the Internet is a driving force for connectivity, automation, and data sharing. He could not understand why there are still forces of resistance and negative narratives surrounding its scholarship. Regrettably, even though information and education are free, seniors do not always want to participate in the learning process. He blamed Watson, the new fourth branch of the government, for popularizing the universal basic income (UBI), making life worries-free, but strangling motivation and ambition.

Other voices in the crowd of pensioners had different opinions and outlook on life in 2037. They think that having access to the Internet of things allows them to not only live well, but to also have access to robotics, smart homes, interactive companions, direct support professionals (DSPs), and certified nursing assistants (CNAs), should the need arise. The reimbursement and human help are readily available.

The environmental sensors, on the other hand, rarely fail, keeping the environment safe and clean. Occasionally, however, there is a big show of force by the robots. It is only a show, and it ends in a friendly discussion about the new generations that will be replacing the older models. Although, many seniors become attached to the robotic companions, and are sad to see them go. The connectivity to the Internet of things prevails again, and the new generation will replace the old.

Youthful Aging

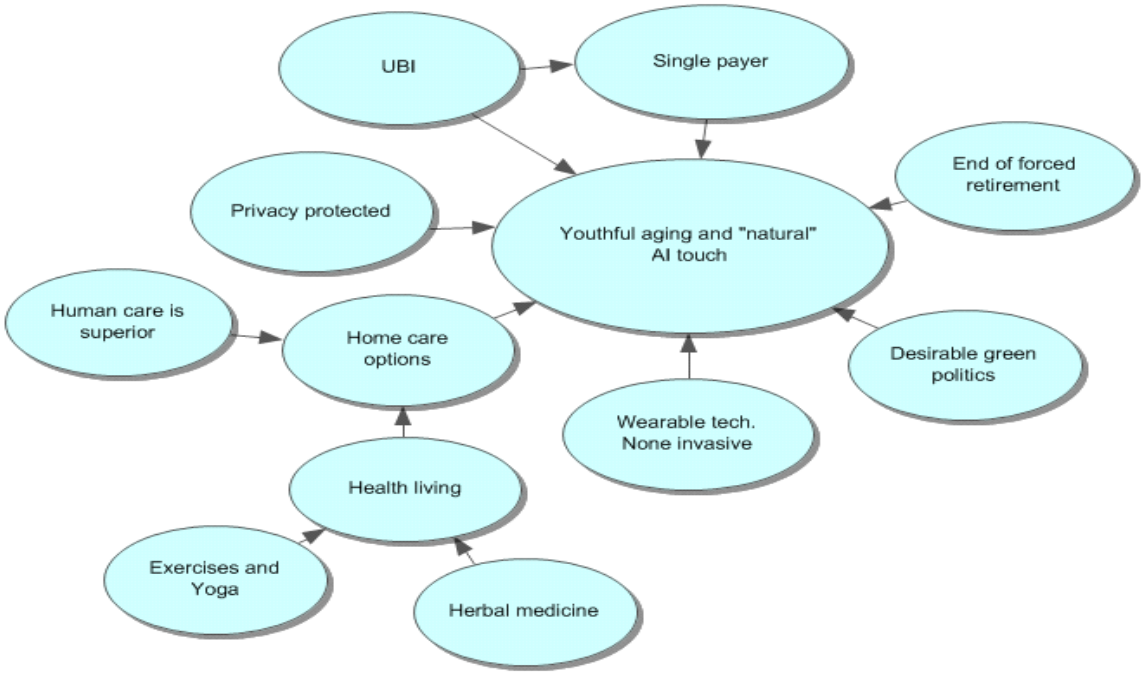


Figure 8. *Youthful aging*.

Vivienne, a young adult, worries about her grandparents (see Figure 8) who rarely leave their house. Her grandfather plays cards with PoPo his robot. He finds PoPo clever and amusing and secretly hopes to beat him in one of the card games one day. Her grandmother loves her robot PoPa for the information and help she gets in gardening and cooking. She wishes PoPa could be upgraded and made physically stronger, but for now she is okay and worth the money. Vivienne worries about their lack of exercise but is impressed and sometimes surprised by her grandparents' ability to reprogram and upgrade their robots.

She should not be surprised as her grandparents are both mathematicians. Even though they are getting older, they never lost their interest in new upcoming technologies.

She thinks it a challenge. An examination of the limits of robotics, biotechnology, nanotechnology, and AT drives them. They wondered how soon modern science will unlock the secrets of aging and slow it down. The question, "what are the probable, possible, and preferred futures of stakeholders in the development of technologies" continues to be essential in the search for longevity.

Vivienne believes that age no longer correlates with the number of years one lives, but with the person's cognitive, physical, and behavioral capacity to function. Her grandparents are a good example. It is their search for the "fountain of youth," questioning the essence of life and their own identity. Perhaps, their secret to success has always been locked in the "green politics" and in non- invasive wearable devises, and human care, which others do not see as advantages.

The technical and scientific innovations worked for them. The higher pay in the universal basic income (UBI) and a one-payer health care system allowed them to be entrepreneurial innovators. They patented improvements to their robots, PoPo, and PoPa, making them wealthy. Although, Vivienne is convinced that it is the spiritual fulfillment that makes them successful, content, and happy. She may be right by saying that the aging clouds never rained on her grandparents because they have always been dependable and trustworthy.

Evidence of Trustworthiness

Trustworthiness, in this study, was assured by following four criteria: credibility, transferability, dependability, and confirmability. To ensure credibility, I first became familiar with the participants' culture without being immersed in it. The purposive

sampling was used to reduce any bias among the pool of participants. To apply triangulation, I implemented a focus group and two questionnaires/surveys. All participants could choose whether to participate. Repetitive questioning was used to expose inconsistencies and address all surfacing matters. Peer review and "reflective commentary" was encouraged. I acknowledged that the background and credentials of the investigator are an essential part of the analysis. The real situations and their meaning were detailed. I examined earlier findings to assess the level of which the investigation's outcomes were compatible with those of previous studies.

Summary

In this chapter I presented the findings based on contributions from members of a New York senior center, a professional expert society, and a university participant pool consisting of the faculty and doctoral students. The results stemmed from discussions during a focus group and two questionnaires. The central themes included CLA's four levels of transformation: litany, social causes, discourse/worldview, myth, and metaphor.

The thematic content analysis revealed the categories of independence, control, impairments, longevity, lifespan, health policy, futures, AT, providers, and generations. Causal layered analyses were employed to develop alternative futures scenarios of AT for the cognitively impaired elderly. The results showed on-going concerns that will be discussed in Chapter 5. Chapter 5 also includes an interpretation of the findings, limitations of the study, recommendations, implications, and a conclusion.

Chapter 5: Findings

Introduction

This social construction qualitative study was conducted to investigate alternative futures applications of AT in aiding individuals 65 years and older who are diagnosed with Alzheimer's and other forms of dementia. Causal layered analysis was used throughout the study as a guiding method of analyzing the textual discourses. The study explored the extent to which AT engineers, seniors, and caregivers perceive that AT will enhance the need for some or all aspects of daily living activities.

The findings showed litany, as the dominant theme throughout the focus group session and continued to be central in eight out of 10 questions in the questionnaires. Litany encompassed the first four focus group questions, followed by two social forces issues, one worldview, two positive and negative myths, and metaphors. The categories found were futures, AT, control, independence, impairments, health policy, providers, and generations.

The final method applied to this study was a scenario construction assisted by an outline and futures wheels. The four alternative futures vignettes took place in 2037 and explored the most desirable, least desirable, most likely, and the emerging culture models. The details were presented in Chapter 4. Each theme and category interlocked, showing comprehensive picture of the future.

Interpretation of the Findings

The examination of the literature for this study corroborated the categories that emerged from the focus group and from the two questionnaires. The participants'

communicated their concerns and stated that discussions about day-to-day concerns were common among the elderly and others they knew. The first question elicited responses related to their concerns about the ergonomic usefulness and functionality of the electronic equipment. The complexities of instructions were burdensome for some seniors. Seniors said they would benefit from repetitive instructions, one-on-one explanations, helping robots, and practical technologies, affirming what has been found in the peer-reviewed literature.

Environmental sensors placed first on the experts' questionnaire, followed by intelligent technologies, and mobile remote monitoring. Voice-activated devices, computers, gaming system, smart phone, and practical interactive games play an important part in the lives of the cognitively impaired elderly. Thus, the practical and technological construct played a significant role in the discussion and questionnaires.

The practical construct included suggestions about a technology that could find things. It was mentioned that sensory overload played an essential role in memory loss and aging. Smart homes were perceived to be geared toward young people.

Caregiving became the focus group's topic of conversation, confirming what was found in the peer-reviewed literature. Some of the caregivers and their loved ones mentioned the need for rest and herbal medication, although one person with Alzheimer's was unhappy with herbal treatments. Another participant declared that all the caregivers in her Alzheimer's support group eventually got cancer.

The issue of independence and control played a major part in the discussion and the questionnaires. One person said music should be a function of technology. The pool

participants thought that a “hand and eye coordination, increase in the audio and visual capabilities, and independence” were important issues. The engineers suggested that computers will be smarter than people but not able to react to different situations the way a human would because compassion and love are human attributes.

Consequently, the focus group seniors considered all state social programs desirable, exercises, and eating important, learning how to use smart devices essential to their wellbeing. It was suggested that the caretakers should prepare for the tasks of caring for the elderly with dementia, because the development of new medication was slow in coming. It was also suggested that virtual reality could help the elderly with daily activities. Thus, seniors believed that accessing the world, being independent and connected to friends and family were the important tools in combating dementia.

The challenges that face the family caregivers and the importance of AT, social services, and support groups were repeatedly raised. Nonetheless, it has been said that training and relearning could address the “burn out” issues, confirming previous findings. However, one senior stated that “caretakers sometimes die ahead of Alzheimer’s patients” was an unexpected statement. It was suggested that we should embrace technology and its ability to provide automated personal assistants.

The positive and negative effects of the environment were of interest, but the economy and politics topped the list of driving forces. The “cost of things” and the factor of affordability was a concern to all participants. Economic incentives were the key to research and development. Driving the cost down using new wearable, implantable

sensors was recommended by the engineering experts, confirming what has been found in the peer-reviewed literature.

However, the engineering experts also suggested that sometimes even incentives are met with resistance. Global politics, long-term solutions, and restrictions were blamed for the challenges of AT adoption. Others blamed the economy and the demography for the cost of technology. As a result, the unpredictability, "the roller-coaster" factor, and the adoption of technology risk, attained the most votes. The opinions varied widely from the "technology is a curse" to "there is no going back" statements expressed by the senior participants.

There is no going back, also met with the seniors suggesting overdependence on technology, nothing can replace the human touch, and annoyances at human behaviors, such as disrespecting others space, time and privacy. The ethical, privacy and policy issues were addressed and met with "less government manipulation," and "more access to protected medical records is needed". Equal access to medical treatment and technology surfaced once again, reconfirming the peer-reviewed literature about wider access to health care services by US citizens.

The health care services have become depersonalized, claimed one senior participant. Medical doctors look at monitors instead of patients was one of the comments. Others thought that the U.S. health care was the best in the world, but expensive, because little progress has been made with insurance providers. As a result, technology has the great potential of improving the elder's quality of life, extend life expectancy by showing its cost effectiveness in common daily use.

Scenarios

Scenarios can be valuable tools to understand the converging and diverging driving forces, and trends. The scientific discoveries, technological innovations, nature, social and political forces mold the future. Policy choices can significantly reshape and improve the human circumstance. To meet ongoing and emerging challenges we need new approaches to address uncertainties facing health policies and the futures that lie ahead. Scenarios are one of many futures techniques. They give us the possibilities of the future by encouraging us to create something new. They help us to be prepared for alternative futures but do not predict or speculate what the future is going to be.

The future cannot be predicted. There is no single future. There is no way of knowing the future, but it is possible to affect aspects of it. The four scenarios presented in this study are narratives, planning tools, written to describe a broad range of alternative futures relevant to the use of environmental sensors, intelligent AT or age-friendly robotics. There are many ways of developing scenarios. The inductive way works well when there is one key variable. The deductive approach works better when there are several key variables. Well-constructed scenarios include "projections and forecasts, discussing the cause an effect linkage of the scenarios" (Glenn, 2009b, p. 2)

Based on the CLA, I developed and linked alternative futures scenarios. Each scenario had a different navigator that captured different components of what can occur. These scenarios showed what possible futures could be like, as well as cautionary circumstances that should be avoided. Thus, the systemic or social causes need to be built into our conversation because economic and political factors are the building blocks of

every nation. The assumption should be that there is no universal model, but there are alternative avenues. To conclusively show the unique contribution of scenario development I employed the futures wheel.

The futures wheel (see Data Collection Instruments) was used in combination with other methods to inform us about underlying forces of change and trends. It allowed for structured brainstorming and organizing thought about possible events and developments.

Limitations of the Study

The futures studies' limitations come from the lack of controlled experiments, and the unpredictability of the future. The aim of my study was to explore assistive technologies that will help the cognitively impaired elderly in the year 2037. That was accomplished by generating data from a focus group (n = 10) at a senior center in New York, as well as questionnaires with family members (n = 5) of the cognitively impaired elderly and engineering society members (n = 16). Limitations stemmed from the limited number of participants and the focus group participants' lack of experience with AT. However, CLA, with its four layers, can help to integrate divergent assessments and beliefs, bringing the application of the results to a wider population less challenging.

The CLA can also be thought provoking because it is a new method, one used in union with other methods. But it is a difficult method for those who see the world as true or false, right or wrong. The litany, social causes, discourse/worldviews, and myths and metaphors are enhanced by these firsthand experiences and scenarios but might be rejected by those with one worldview.

The process of developing scenarios can help to develop pre-emptive awareness. Since transformation continues to gather speed, plans change. The scenario building process can alter the way researchers and planners think about the future. Optimization against a specific target is substituted by a well-adjusted range of evaluations. This flexibility allows researchers to better understand the alternative futures. The weakness of scenarios is that the research non-participants, who look at the scenarios, can think of them as the "indorsed set of viable futures" and hence, limit their thinking.

Another limitation comes from scenarios ability to persuade the non-participant in subtle way about cause and effect. Thus, the mental model is transferred to the non-participant, and possibly unconsciously accepted. Although the harvest of the futures wheel when carefully used can be a foundation for further exploration and thinking, a futures wheel can also be helpful in determining impacts and consequences.

Summary of the Findings

My qualitative research was designed to examine alternative futures of AT in aiding individuals 65 years and older who are diagnosed with Alzheimer's and other dementia. The ongoing demographic and socioeconomic changes in the United States have increased the awareness and interests in the management of cognitive impairments in the elderly.

The responses of the 21 participants revealed litany as a dominant theme throughout the focus group session and continued to be central in eight out of the 10 questions asked in the questionnaires. Answers to the other two questions elicited discussion about the economy, politics, demography, advances in medicine, and health.

The roles of the state and social issues were of interest to the elderly and suggested attention to AT and the cognitively impaired elderly is increasing.

New AT innovations will likely improve the quality of care as well as the life quality of the cognitively impaired elderly and that of their caregivers, especially when they share the same living quarters. The multitude of environmental sensors, intelligent AT, remote mobile monitoring, biosensors, video, and audio technologies, and robotics can monitor the safety, health, and welfare of the cognitively impaired elderly.

Recommendations

Future researchers should consider field tests to show the practical side and the usefulness of environmental sensors that perform tasks associated with shortages of available caretakers. Researchers have suggested that early intervention can ease the duties of those caring for individuals with dementia. Additional educational and training programs may increase the caregiver's use of AT. There is an urgent need to recognize when and how caregivers, can benefit from AT.

More studies are needed to prove the efficacy of AT. Future studies could benefit from a more significant number of participants. One of the confines of this study was that some of the technologies are still in the developmental stages. It is difficult to find a "one-size-fits-all" solution because people with dementia exhibit a complex variety of symptoms.

The lack of engagement may also be the result of low or no financial reimbursement from insurance companies. Compensation would incentivize the meaningful use of AT and encourage caretakers to integrate it into the daily life of the

cognitively impaired elderly. Awareness and use of AT would increase, caretakers' duties decrease, and job popularity increase.

Additional research exploring the use of AT is necessary. There continues to be an increasing need for assistance for specialized groups of individuals with disabilities, such as the single elderly with cognitive impairments. Larger numbers of the elderly are living alone, willing to use AT. However, despite this potential, adoption rates remain low. This is in part because of a lack of endorsement and commitment by new tech companies. Thus, a wider scale of research about single cognitively impaired elderly and assistive technology is needed.

Research has focused on designs, and on innovative technologies, to assist people in their cognitive and physical functions. Many complex technological innovations and discoveries propelled us forward, but simplicity of use and design can mean more to an elder adult. The failure to implement simplicity can make the elderly population frustrated, and disempowered. Thus, the goal of researchers and engineering experts should be to improve the cognitive health of people with dementia by applying simple rules to the use of technologies.

Implications for Positive Social Change

These findings have positive social change implications for nursing, and long-term care practices as they explore the litany, social causes, worldviews, and myths and metaphors that will drive the future use of AT with the aging cognitively impaired population. The findings give more insight into the effectiveness of various ATs that are

being developed and considered as a way of improving care and reducing costs associated with care for these individuals.

The developments may lead to a broader discussion of some of the probable implications of our myth, assumptions, and images of the future that will provide a better understanding of AT innovation and its future applications. The innovations can inform the social systems where health policies for long-term and short-term care are inadequate, and the process of informing the elderly about health insurance and monetary reimbursement less daunting.

The reality is that policymakers did not yet establish calculus by which to evaluate the direct, mid-term, and long-term impact, AT could have on the elderly. We have formed a new arena of life but have not yet envisioned all of its opportunities. Unfortunately, rather than celebrating innovations, the longer life spans created fear among policymakers. However, the elderly will not bankrupt our society but contribute their lifetime of experience to positive social change.

Many elderly will work and participate in group activities that are different from those in which their parents engaged some time ago. AT will affect how older people conduct their daily activities, solve problems, and adapt to change. The elderly will be less intimidated by the technology when they use environmental sensors, intelligent AT, and robotics daily.

The daily use of AT will contribute to lower health care costs. Multi-generational policies and programs need to be developed. We have to examine issues through a lens on aging that identifies the value of experienced older adults. The accurate assessments

will ensure the right outcomes. The policy design of AT benefits will have a positive, measurable, sustainable impact on our society.

Thus, academics have convincingly argued that technology moves policies and societies to constitute positive social change. The rapid progression of modernization parallels better living conditions for the young and old alike. The shift in technology becomes an irresistible force. The new developments necessitate behavioral and environmental changes. Technology emerges as a driving force that will shift economies, politics, and demographics of nations.

Conclusion

This qualitative study was conducted to explore the alternative futures of AT in helping the elderly who are diagnosed with Alzheimer's and other dementia. All participants understood the complexity of aging and dementia. Twenty-one participants took part in a focus group and two questionnaires. The participants were asked to address existing and the future of AT for the impaired elderly.

The aging of populations is a worldwide phenomenon that presents many challenges. There is growing evidence that ATs can bring about significant benefits to people with dementia while increasing the cost-effectiveness of health care and social services. The focus of this research was on how AT can be used to enhance independence and aging, and in identifying emerging technological developments. Technologies such as environmental sensors, intelligent AT, remote mobile monitoring, biosensors video and audio technologies, robotics, and others can benefit our society through health care savings and workforce participation of the seniors.

People in developed countries can expect to live into old age. In many ways, present society and its economic and political institutions are just coming to terms with the progress in life expectancy over the last 50 years. The reduced mortality rates, improved standards of living, and speedy advances in medical treatments have not eliminated the stereotypical depictions of older individuals. In many ways we fail do recognize the positive experience older individuals have on our society.

Generally, older adults are receptive toward AT, especially when using these devices increases the potential to remain independent. Continued innovations will allow future generations of the elderly to age in place, remain independent, stay connected to their love ones, and take advantage of life-saving applications. Assistive technology has provided seniors with an interactive lifeline to the word, empowering them to live healthy, independent lives.

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Appendix A: Focus Group Protocol

Three phases:

1. Preparation
2. Administration
3. Interpretation of results

Preparation

- Focus group, held in a in a senior center
- Participants recruited via weekly/monthly institutions' activity paper
- Questions generated ahead of time
- Facilitator is the researcher
- Note taker takes notes
- Recorder records the participants

Administration

- Paper, posted notes, markers are provided
- Introduction is presented
- Consent Form is distributed
- Focus Group time frame 45 to 90 minutes
- Participants are thanked

Interpretation of Results

- Summarization of Focus Group is created
- Notes transcribed
- Summaries analyzed
- A report is written
- Adjustments are (clean-up of unnecessary words) made

Appendix B: Focus Group Questions

Litany

Please call out [list]: What specific technologies or innovations do you think would be most beneficial to assist the cognitively impaired?

What functions [senses, abilities] should new technology provide to assist the cognitively impaired?

What are the challenges or issues that face the cognitively impaired that technology might potentially address?

What are the challenges or issues that face the caregivers of the cognitively impaired that technology innovation might potentially address?

Social Forces

Which driving forces [show list: economy, environment, demography, globalization, social, political] will be the strongest to encourage new assistive technology innovation? Why?

Which driving forces [show list: economy, environment, demography, globalization, social, political] will be the strongest to resist the adoption of new assistive technology innovation? Why?

Worldview

Are new technologies [show list] more: helpful tools, anti-human objects, or tools that change humans as they modify their tools? Why?

[Show of hands] Is the future most like:
a game of chance?
a roller coaster?
a river?
an ocean?

Myth and Metaphor

What are the stories, narratives, and myths in your community about technology and the role of technology in society? Positive ones? Negative ones?

What are the stories, narratives, and myths in your community about medicine, healthcare, and caregiving as they relate to assistive technologies?

Appendix C: Questionnaire/Survey

Assistive technology may be the future remedy for delaying the elders' need for long-term hospitalization and promotion of independence. Little is known, about the potential utilization of assistive technology for the cognitively impaired elderly. The purpose of this questionnaire is to obtain the expert opinion about the use of assistive technology. You are invited to write a response that best characterizes how you as an expert in the field of assistive technology feel about the matter.

Questionnaire

Futures of assistive technology for the cognitively impaired elderly

1. Rank the top three technologies (#1, #2, #3) that you feel will best support "aging-in-place" by 2037 and why?

    - Environment sensors ( )
    - Video and audio technologies ( )
    - Biosensors ( )
    - Remote mobile health monitoring ( )
    - Ubiquitous or Pervasive Health Technologies ( )
    - Intelligent Assistive Technologies ( )
    - Robotics ( )
    - Other ( )

2. By 2037, to what extent will assistive technology sensors be able to comprehend and react to a situation the way a human would?

3. How will new technologies – stem cell, gene therapy, and assistive technologies provide protection from cognitive impairments such as dementia?

4. How will intelligent assistive technologies sense and act in response to elder users' physical and cognitive deficits?

5. What types of implanted sensors used to improve, and measure health parameters will be popular (or in demand) by 2037?

6. What cognitive orthotics (cognitive aid devices) will assist cognitively impaired elderly with cognitive tasks and memory assistance?

7. At what point will context-aware computers capable of determining the environment before triggering a reminder or dispensing an intervention become an integral part of the elderlies' daily support system for those with cognitive or physical impairments?

8. What events will render patient-centered, home-based systems the foundation of the health care system?

9. What types of legal and ethical issues arise in the next decade in order to prompt an increase in the use of intelligent assistive technology tools?

10. If clinical trials demonstrate medical efficacy of assistive technologies, when do you think insurance reimbursement for the purchase of assistive technology will become a reality?

Appendix D: Project Summary

Assistive technology may be the future remedy for delaying the elders' need for long-term hospitalization and promotion of independence. Little is known, about the potential utilization of assistive technology for the cognitively impaired elderly. The purpose of this study was to promote independence via the use of assistive technology and to increase the awareness of cognitive impairments. Research questions converged on futures and today's usage of assistive technology such as iPads, tablets, and practical wearable devices, robotics, your view on medicine and technology, and barriers to usage of technology among the cognitively impaired elderly. A qualitative futures study design was utilized, using a focus group meeting and questionnaires with expert and Walden University pool participants. Data from each group of participants was coded and labeled according to the exploratory thematic content analysis with closeness to research questions and study's objectives.